THE M-1 TANK AND NATO READINESS

HEARINGS

BEFORE THE

SUBCOMMITTEE ON INTERNATIONAL TRADE, FINANCE, AND SECURITY ECONOMICS

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THE M-1 TANK AND NATO READINESS

TUESDAY, JULY 21, 1981

CONGRESS OF THE UNITED STATES, SUBCOMMITTEE ON INTERNATIONAL TRADE, FINANCE, AND SECURITY ECONOMICS OF THE JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:05 a.m., in room 5110, Dirksen Senate Office Building, Hon. William Proxmire (vice chairman of the subcommittee) presiding.

Present: Senators Proxmire, Symms, and Jepsen.

Also present: Richard F. Kaufman, assistant director-general counsel; and Chris Frenze and Keith B. Keener, professional staff members.

OPENING STATEMENT OF SENATOR PROXMIRE, VICE CHAIRMAN

Senator PROXMIRE. The subcommittee will come to order.

Gentlemen, we are very happy to have you here. This is a pretty grim problem that faces us, and I think it is just typical of the problems that our defense effort has and I am looking forward eagerly to having your analysis of it and your recommendation as to what we can do about it. The M–1 tank problem falls into three categories: Cost overruns; disappointing test results in the areas of reliability and maintainability; and future effects on readiness. The M–1 program follows two earlier Army efforts to build a new main battle tank in the late sixties and early seventies. Both were canceled because of cost and performance problems.

In 1974 it was estimated that 3,323 M–1 tanks would cost $3 billion, or $900,000 each. The current estimate is that 7,058 M–1 tanks will cost $19 billion, or $2.5 million each. And there is reason to believe that the costs will go considerably higher, to perhaps as much as $3 million before we're through. Adjusting for the increase in quantities, there is presently a cost overrun of about $5 billion.

Now, the Army obviously, needs a new tank and every study of our NATO forces that I've seen demonstrates the need to improve the level of readiness. It is precisely these needs that cause concern about the M–1. Will the Army's new tank actually increase or lower the readiness of our forces, and will the astronomical costs of this program represent a prudent investment in military preparedness or a drain on the economy and the Federal budget?

More important than the cost overruns, and I mean more important than the cost overruns, although all of us are very concerned about that—I certainly am; they are appalling. But more important than the cost overruns are the disappointing results of the M–1 tests that have been reported by the General Accounting Office.

The third and latest series of M–1 tests were started last year and completed at the end of May of this year. Today I understand you gentlemen will present your analysis of the results of the tests. The facts about the latest tests are critical for several reasons. The Army will decide in December whether to increase the production rate from 30 to 60 tanks per month. More than $2 billion has already been budgeted to be spent on the M–1 in fiscal year 1982. That amount will undoubtedly go much higher as the program proceeds.

Is the tank ready to go into full production? Is it ready to be sent to Europe? The Army has had big difficulties with building a new tank. It has made a serious blunder in sending a new tank to Europe in the recent past. It is not generally known that the A–2 version of M–60 is still in the process of being recalled because of problems with the tank. I understand that 543 of these tanks have been brought back from Europe and are still being brought back because they turned out to be useless. According to my staff, these useless tanks cost about $675 million in 1981 dollars.

Our witnesses this morning are two spokesmen for the General Accounting Office, both of whom are in charge of investigations of the M–1. Donald J. Horan, Director of Procurement, Logistics and Readiness Division, supervised the GAO report released earlier this month entitled "Logistics Planning for the M–1 Tank; Implications for Reduced Readiness and Report Costs." Walton H. Sheley, Director of Mission Analysis and Systems Acquisition Division, is in charge of an ongoing separate study on the M–1.

Gentlemen, I have your excellent prepared statements which will be placed in the record in full. We would appreciate it if you could give us the highlights, so that we have time for questions. I want to thank you once again for your hard work and your fine analysis, and we are looking forward to your presentation and your response to our questions.

Mr. Sheley, please proceed.

STATEMENT OF WALTON H. SHELEY, JR., DIRECTOR, MISSION ANALYSIS AND SYSTEMS ACQUISITION DIVISION, GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY HYMAN BARAS, GROUP DIRECTOR, LAND WARFARE AUDITS; RICHARD BECKEMAN, SENIOR EVALUATOR; AND MARTIN M. FERBER, GROUP DIRECTOR, INTEGRATED LOGISTICS

Mr. SHELEY. Thank you, Senator. We are pleased to appear before your subcommittee to present the findings of our latest review of the Army's M–1 tank and the acquisition aspects of the tank, its operation and development cost, and its cost in initial production. Mr. Horan, who will follow, will address the M–1's logistic planning.

RESULTS OF M–1 TESTING—RELIABILITY, AVAILABILITY, MAINTAINABILITY, AND DURABILITY (RAM–D)

The M–1 completed its third and final phase of operational testing last month at Fort Knox, Ky., and Fort Hood, Tex. Development testing will be completed at the Aberdeen Proving Grounds center

in Maryland, next January. We have observed portions of the testing at all three locations and reviewed the raw testing results.

The M–1 tank is impressive in meeting its three major combat requirements: Firepower; mobility; and armor protection. Its superior stabilization system gives it an edge over the current deployed M–60 tank in firepower particularly in its shoot-on-the-move capability. It can travel at much higher speeds, especially over rugged terrain and can accelerate better. Its special armor and compartmentalization of its ammunition inside the tank are expected to give it better survivability than the M–60. These advantages are considerably offset, however, by major shortcomings in most of the so-called——

Senator PROXMIRE. May I just interrupt for a minute? What statement are you reading from?

Mr. SHELEY. A summary, sir.

Senator PROXMIRE. This is a summary of your prepared statement? I was trying to follow with your statement.

Mr. SHELEY. The points are all in there.

These factors refer to the tank's reliability, availability, maintainability, and durability. Reliability refers to the mean number of miles the tank can travel between failures. There are two types of reliability measurements: System reliability considers failures which impair the functioning of the tank but not to the extent that it could not continue in its combat mission: and combat mission reliability only considers failures that make it impossible or imprudent to continue the mission. The Army's system reliability goal is 501 mean miles between failures. Tentative results on the testing of four tanks at Fort Knox showed that they had achieved the score of 130 mean miles between failures. Against a combat mission goal of 320 mean miles between failures, the tank achieved 304.

In development testing at Aberdeen where three tanks were tested, the M–1 did not fare as well. With about 60 percent of the testing completed, the M–1 scored 75 mean miles between failures in system reliability and 651 mean miles in combat mission reliability. These scores will probably all be raised when the Army completes its final evaluation of the results. I should point out, though, that these scores are primarily designed to assess the product delivered by the contractor and do not consider mishaps during testing attributed to crew error during operation, maintenance errors or accidents. Neither do they include breakdowns that could be repaired within 30 minutes. If such failures requiring maintenance would consider the mean miles between failures, it would be about 30.

Inherent availability is the percentage of time tanks are available for operation. It is derived——

Senator PROXMIRE. Mean miles would be about 30, you say, if you included the breakdowns because of maintenance and errors by the people who are driving them, and so forth.

Mr. SHELEY. And accidents.

Senator PROXMIRE. And accidents. How does that compare? This is the M–1?

Mr. SHELEY. Yes, sir.

Senator PROXMIRE. How does that compare with the other tank?

Mr. SHELEY. I don't have the data readily available, but I think it is considerably less than the M–60.

Senator PROXMIRE. Considerably less?

Mr. SHELEY. The M–60 is much more mature.

Senator PROXMIRE. In other words, the number of miles you get without a breakdown are less in the new tank by quite a bit; is that right?

Mr. SHELEY. I would think that is correct, sir.

Senator PROXMIRE. So the performance is much worse?

Mr. SHELEY. At this point in its life it is. Inherent availabilty is the percentage of time tanks are available for operation. It is derived by dividing the number of operating hours by the sum of the operating hours and the number of hours the tanks are down for unscheduled maintenance. Against an inherent availability requirement of 89 to 92 percent, the tanks achieved 54 percent at Fort Knox. At Fort Hood, where 41 tanks were involved in operational testing, the availability achieved was 86 percent. Individually, however, those tanks accumulated an average of less than 650 miles. We believe the availability score at Fort Knox where the tanks which were tested averaged about 3,500 miles, is a better indicator.

Maintainability measures the number of maintenance hours expended for each hour of tank operation. The maintenance ratio sought is 1.25 to 1. At Fort Knox the tanks scored 2.86 to 1, and at Aberdeen, 1.71 to 1. Because of the low mileage at Fort Hood, the data is not really meaningful.

Durability refers to the ability of certain components to operate a specific number of hours or miles without replacement. Early in 1980 we reported to the Congress our concerns about the power train's failure to meet its durability requirement in testing up to that point. The requirement is for the power train to have a 50 percent probability of operating 4,000 miles without having to replace any of its three major components, the engine transmission or final drive.

The principal problems in the 1979 tests and in other previous testing were with the engine. The Congress therefore appropriated funds for the Army to begin developing a backup diesel engine. Current testing shows that the turbine engine's durability has not improved. In fact, the durability scores were lower this year than in the 1979 test.

Against the 50-percent requirement, the M–1 showed only a 15-percent probability of operating 4,000 miles without replacing a major component. In developing testing at Aberdeen, it achieved a probability of 34 percent with testing 60 percent complete.

The question is often and legitimately asked, whether the M–1's Ram-D problems are unusually high in comparison to the M–60's. The results of the 1976 test of five new M–60A–1 tanks at Fort Hood, compared with the current M–1 test scores, showed the M–1 ahead in system reliability but trailing in combat mission reliability, availability and maintainability. The M–60's durability was not measured in the 1976 test.

Senator PROXMIRE. I missed that. Will you go back and tell me what was the comparison again?

Mr. SHELEY. The comparison was between system reliability. In that case the M–1 scored higher. But in other areas of reliability, combat mission reliability, availability and maintainability, the M–60 outscored the M–1 tank.

UNIT COST OF M–1 TANK

Turning now to the M–1's cost, the latest reported unit production cost estimate is about $2.5 million per tank. The latest estimate of the M–60–A–3 unit costs we have been told by the Army is about $1.2 million. In December 1980, the Army reported a very substantial increase of almost $6 billion in the M–1's program cost. This increase stemmed principally from upward revisions of the inflation rate previously used and from a change in the base used to project the tax costs to more nearly reflect the costs that the M–1 prime contractor, Chrysler Corp. had proposed for the first 3 years supply. The higher anticipated costs forced the Army to reduce its planned first year buy from 110 to 90 and its second year buy from 352 to 309. From the production performance of some contractors, however, it does not seem that they could have delivered any more tanks, even if additional funds had been available.

Both Chrysler and Avco, the turbine engine contractor, had lagged far behind in their production. Through last month, Chrysler was to have delivered 220 tanks, but had delivered only 125. Avco was to have delivered 407 engines, but delivered only 180. Both contractors assert that problems experienced in transitioning from development into initial production have been corrected and that they will start immediately meeting their delivery commitments.

The Department of Defense is to decide this September whether to permit the Army to increase its rate of M–1 procurement above the present limitation of 30 a month. This decision is to be based on the prognosis for the M–1's achieving its RAM–D objective by the end of the current testing. We would urge that the Department of Defense also continue with the development and testing of the backup diesel engine in view of the failure to improve the turbine to a more acceptable level of durability in more than a year's time.

[The prepared statement of Mr. Sheley follows:]

PREPARED STATEMENT OF WALTON H. SHELEY, JR.

Mr. Chairman, we are pleased to appear before your Committee to present the findings of our latest review of the Army's M–1 tank. As you know, we have been examining the tank's acquisition from its inception.

PREVIOUS M–1 TEST RESULTS

In January 1980 we reported on the M–1 performance in the mobility tests at Fort Knox which were completed in December 1979. Those were special tests ordered by the Secretary of Defense because earlier testing had shown the tank to be seriously deficient in reliability and durability.

At the conclusion of the 1979 Fort Knox tests, the Army's evaluation showed that the tanks performed well enough to raise the level of mean miles between system failures to 107 and the mean miles between combat mission failures to 299.

A system failure is one which impairs the functioning of the tank but not to the extent that it could not continue in its combat mission. A combat mission failure is one that makes it impossible or imprudent to continue the mission. The results achieved at Fort Knox in 1979 were higher than the Army's goals of 90 mean miles between system failures and 272 mean miles between combat mission failures.

The M–1's durability goal in the Fort Knox testing was .50 and the tanks achieved a level of .44, according to the Army's evaluation. The .50 goal is defined as a 50 percent probability that the tank's power train would operate 4,000 miles without a need to replace the engine, transmission, or final drive—the three major components making up the power train.

We concluded that the test scores were not an accurate barometer of the M–1's reliability. Principally, we felt the tests were not as stressful as operational tests and that the tanks had received the benefits of an inordinate amount of maintenance, not to be expected in a combat environment. We advised waiting until after the third and final round of operational and development testing before reaching a definite conclusion as to the M–1's reliability and durability.

In our January 1980 report, we also recommended that, unless the M–1's turbine engine showed improvement, the Army should start a backup diesel engine development program. The Congress appropriated funds for starting this development and a contract was awarded. However, there are no signs that the Army is interested in further pursuing a backup diesel engine after the current development contract is completed.

CURRENT TEST RESULTS

Our latest review covered the M–1's final operational and development testing. For these tests higher reliability goals were established—101 mean miles between system failures and 320 mean miles between combat mission failures. The durability goal of .50 remained the same. The maintainability goal was to expend no more than 1.25 manhours of maintenance for every hour of tank operation.

Operational testing ran from September 1980 to June 1981. Testing was done at Fort Knox, Kentucky with 4 tanks, and at Fort Hood, Texas with 41 tanks. Development testing, conducted principally at the Aberdeen Proving Ground Center, Maryland, began in September 1980 and is to be completed in January 1982. Some additional development testing was done at several other locations to assess performance in extreme climatic and environmental conditions. The final Army test evaluation reports will not be available for some time. However, we have examined interim reports and made some analyses of our own from the raw test data.

At two of three locations where we observed the tests—Fort Knox, and the Aberdeen Proving Ground Center—the tentative results, as scored by the Army, showed that, generally the M–1 was falling short of achieving most of its reliability, durability, and maintainability goals. Although the Army did not measure these parameters at Fort Hood, our own analysis of tests conducted there confirmed the results at the other locations.

The results, in comparison to the goals, are shown in the following tabulation.

Category	Goal	Achieved	
		Fort Knox tests completed	Aberdeen tests 60 percent completed
System reliability (mean miles between failures)	101	130	75
Combat mission reliability (mean miles between failures)	320	304	251
Power train durability (probability of operating 4,000 mi. without replacing a major component of the power train)	0.50	0.15	0.34
Maintainability (man-hours of maintenance to hours of operation)	1.25–1.0	2.86–1.0	1.71–1.0

Earlier, I referred to the current scores as "tentative". This is because the Army will make one further analysis before publishing the final results. This analysis will probably result in higher achievements than the present scores indicate. For example, in the 1979 test at Fort Knox the analysis resulted in the system reliability score being raised from 94 to 107, and combat mission reliability from 286 to 299. It is conceivable that when the current test scores are similarly analyzed the final combat mission reliability score will approach or exceed the goal but it is virtually certain that the durability and maintainability goals will not be achieved.

RELIABILITY

At Aberdeen, reliability of the M–1 tanks decreased progressively as they accumulated mileage. The following table shows that the reliability of the three tanks tested there fell further behind the reliability goals after each of five scoring conferences convened by the Army to evaluate the test scores.

	Scoring conference				
	Goal	1st	2d	3d	4th	5th
Accumulated mileage		3,275	4,588	5,977	8,917	10,984
System reliability	101	93.6	81.9	76.6	76.0	75.0
Combat mission reliability	320	448	428	344	277	251

On the other hand, the Fort Knox results do not show a consistent pattern, as indicated below:

	Scoring conference				
	1st	2d	3d	4th	5th
Accumulated mileage	1,622	4,244	6,131	9,386	14,026
System reliability	81	125	109	107	130
Combat mission reliability	193	319	296	277	304

We have not completed our analysis of these statistics and, at this point, are unable to account either for the progressive decline in reliability at Aberdeen, or the sudden improvement during the last 4,600 miles of testing at Fort Knox.

The system and mission reliability statistics developed by the Army were designed to assess the product delivered by the contractor in accordance with certain criteria adopted by the Army. These are not, however, fully indicative of the reliability to be anticipated on the battlefield. The Army's statistics do not consider breakdowns or mishaps which it attributes to crew error during operation, maintenance errors, mishaps resulting from accidents, temporary quality control problems, and breakdowns that could be repaired within 30 minutes.

These mishaps are relevant, however, in assessing the M–1's potential for sustained performance. Therefore, we tabulated the average number of miles the tanks traveled before they had to stop for unscheduled maintenance. The miles traveled were:

	Number of tanks	Total miles traveled	Average miles per tank	Miles between stoppages for unscheduled maintenance
Aberdeen	3	10,984	3,661	30
Fort Knox	4	14,026	3,506	32
Fort Hood	6	1,702	284	89

The Fort Hood statistics are on six of the total of 41 tanks being tested there that we selected at random to make our own analysis, since the Army did not measure reliability at that location. The higher achievement at Fort Hood is undoubtedly due to the very small mileage accumulated there.

AVAILABILITY

Another assessment of the M–1 tank can be made by comparing it's availability during the tests with the Army's requirement of 92 per cent inherent availability, as stated in its M–1 justification documents. Inherent availability is defined as the relationship of operating time to operating time plus time spent on unscheduled maintenance.

Two other availability measurements are "achieved" and "operational". Achieved availability considers the additional factor of scheduled maintenance and operational availability further consider standby time and down time awaiting logistics support.

The emerging results at the operational test sites show:

[In percent]

	Fort Knox	Fort Hood
Inherent availability	54.2	86.1
Achieved availability	48.7	83.2
Operational availability	45.9	48.2

The Aberdeen tests did not measure availability.

The much better showing at Fort Hood in the first two categories, we believe, is again due to the low mileage accumulated by the 41 tanks tested there, compared to the mileage accumulated by the 4 tanks tested at Fort Knox. Consequently, their required maintenance would have been much less, and their availability much higher. The low operational availability at Fort Hood was due to problems with logistically supporting the tank, principally obtaining replacement parts, and excessive time repairing the tanks due to defective tests sets and maintenance manuals.

DURABILITY

Power train durability has declined from the level it achieved in the Fort Knox tests in the previous year. Following is a comparison of power train failures by components experienced in the earlier Fort Knox tests with those experienced in the current tests.

	1979 tests	Current tests
Mileage accumulated	16,070	17,143
Power train failures:		
Engine	3	
Transmission	3	2
Final drive	0	1
Durability achieved	0.22	0.15

This comparison shows the results achieved before the Army's final analysis discussed earlier. In 1979, the analysis doubled the durability score from .22 to .44. It is doubtful that a similar analysis of current durability scores will be sufficient to raise the result to the .50 goal even with the higher .34 score attained at Aberdeen, where testing is 60 percent complete. To reach the .50 goal will require accumulating more mileage without a durability failure than is planned in the tests remaining.

MAINTAINABILITY

The most recent series of tests was the first in which the Army attempted to measure the M–1 tank's maintainability. The results show the tank to be below the Army's objective of attaining a level not to exceed 1.25 manhours of maintenance for each hour of operation. The ratios achieved were:

	Fort Knox	Aberdeen
Mileage	14,026	10,984
Maintenance ratio	2.86 to 1	1.71 to 1.

At Fort Hood, we developed a ratio of .31 to 1.0 for unscheduled maintenance for the six tanks we chose at random. This low ratio is, again, due to the low accumulated mileage.

The inadequate test sets and maintenance manuals were also problems at all test locations and have plagued the M–1's maintenance since the tanks were first delivered. The test sets frequently diagnose problems incorrectly. The manuals are frequently incomplete or incorrect. At the Aberdeen Proving Ground the test sets were judged only 65 percent accurate. Fort Hood personnel judged

their accuracy to be much lower. Maintenance personnel at all test sites often relied on their own technical knowledge and instincts in preference to relying on the test sets. It is to be expected that improvements in the manuals and test sets, and improving the delivery of spare parts, along with more experience in maintaining the M–1, will eventually reduce the disppointing maintenance burden to more acceptable levels.

COMPARISON TO M–60 TANK

A question that is often and legitimately asked is whether the M–1's reliability, availability, and maintainability problems are unusually high, or whether they are comparable to problems experienced with the currently deployed M–60 tank. In 1976, a reliability test of tanks, including five new M–60 A1s coming off the production line, was conducted at Fort Hood by the TRADOC Combined Arms Test Activity, the same organization that tested the M–1 at that location this year. The M–60 A1 tank was an improved version containing a newly developed engine and improved track and gun stabilization. Testing was conducted under expected operational conditions and failure criteria were the same as developed for the M–1 tank. The five tanks accumulated a total of 11,292 miles and showed that the M–60 was superior to the M–1 in all test results except for system reliability. Durability, where the M–1 is the weakest, was not scored in these tests. A comparison of the test results follows:

	M–1			M–60
	Fort Hood	Aberdeen	Fort Knox	
Miles accumulated	25,925	10,984	14,026	11,292.
System reliability (mean miles between failures)		75	130	101.
Combat mission reliability (mean miles between failures)		251	304	395.
Maintainability (man-hours of operation)		1.74 to 1	2.86 to 1	0.41 to 1.
Inherent availability (percent)	86.2	Not measured.	54.2	92.
Achieved availability (percent)	83.3	do	48.7	87.
Operational availability (percent)	48.4	do	45.9	81.8.

M–1'S COST

The cost of the M–1 has increased significantly since its development began. The latest average procurement cost for the 7,058 tanks in the program, as reported by the Army in March, was about $2.5 million per tank.

The program has undergone several changes since it was started. Inflation rates used to estimate costs for the duration of the program have been changed several times. The original quantities have increased from 3,312 to 7,058 and the planned monthly production rates have gone from the original 30 a month to a build-up of 90 a month with a surge capacity of 150 tanks a month. Another planned change since the program's inception would incorporate the 120mm gun to replace the 105mm gun about 1984. The cost of modifying the tank for this change is included in the current estimate.

A particularly large increase in the program estimate—almost $5.9 billion—was reported in December 1980 over the previous quarter's estimate. The largest portion of the increase, about $4 billion, was due to a change from the data base used early in the program for estimating costs to a new data base consisting of the contractor proposals for the 1979, 1980 and 1981 procurements.

For the future we foresee further significant changes in the M–1 cost estimates. For example, the costs reported in March already reflect lower projected escalation rates than were used in the December estimate. Escalation rate projections may continue to fluctuate.

The rate of production will also be a factor in future cost estimates. The recent infusion of funds into the fiscal year 1982 budget may have enabled the Army to avoid stretching out the procurement of many weapon systems like the M–1 tank, with resulting higher unit costs. But if future funding constraints materialize similar to the one that occurred this year it could again force changes in the production schedule and, in turn, increases in program costs.

Changes in the production schedule will also influence the number of tanks to be outfitted with the more expensive 120mm gun currently planned to be incorporated in 1984.

M–1 PRODUCTION

M–1 production has not kept pace with planned deliveries. The tank is being produced at a Government-owned plant in Lima, Ohio, operated by Chrysler Corporation. A second plant, in Warren Michigan, is being readied for production to start this November. Engines are being produced by AVCO Corporation at Stratford, Connecticut, and the transmissions are produced at Detroit Diesel Allison, a division of General Motors.

Through last month, Chrysler was to have delivered 220 tanks but had delivered only 125. AVXO was to have delivered 407 engines but had delivered only 180, including 13 to be used as spares. Allison, after a slow start due to a delay in receiving Government-furnished equipment and tooling, had about caught up with its contract delivery schedule of 397 transmissions.

AVCO told us that it's difficulties stemmed from problems in transitioning from development to production. A spraying operation to permit engines to withstand high temperatures had to be contracted out when AVCO's own equipment was down. Other operations which were to have been automated had to be performed manually pending delivery of certain manufacturing machinery.

Chrysler's contract called for it to begin producing in excess of 30 a month beginning last March. Chrysler contends that it did not produce to the schedule because it was waiting for more engines to be delivered. However, Chrysler's production in June 1981, a month in which AVCO produced 29 engines, was only 18 tanks.

In summary, while the M–1 tank is impressive in meeting its three major combat requirements—firepower, mobility, and armor protection—these advantages are offset to a considerable degree by shortcomings in most of the so-called RAM–D factors, and by the M–1's rising cost. Engine failures have been more frequent and the maintenance burden is substantially above the Army's desired levels. What concerns us most is that the efforts to improve the durability of the power train do not appear to have made much progress in the past year.

The Department of Defense is to decide in September whether to permit the Army to increase its rate of M–1 procurement above the present limitation of 30 a month. This decision is to be based on the prognosis for the M–1's achieving its RAM–D objectives by the conclusion of the current testing.

We would again urge that the Department of Defense also consider continuing with the development and testing of a back-up diesel engine in view of the failure to improve the turbine to a more acceptable level of durability than a year ago.

Senator PROXMIRE. Thank you, Mr. Sheley.

Mr. Horan.

STATEMENT OF DONALD J. HORAN, DIRECTOR, PROCUREMENT, LOGISTICS, AND READINESS DIVISION, GENERAL ACCOUNTING OFFICE

Mr. HORAN. Senator, I would like to briefly highlight some important issues discussed in our July 1 report on logistics planning for the M–1 tank. A more detailed prepared statement is being provided for the record.

LOGISTICS PLANNING

Because of pressures to attain specific performance goals within tight time and acquisition cost restraints, Army management gave insufficient attention to M–1 logistics support and to long-term ownership costs. As a result, the development of logistics support lags behind the tank's development and the scheduled completion dates for satisfying various support needs are still several years away. This is critical, because current M–1 program milestones call for decisions this September on whether to authorize full production and to field the M–1 in Europe.

In addition, there are serious tank support problems in Europe that could become exacerbated by premature fielding of the M–1. Although it is impossible to predict the consequences of a decision to go ahead and field the M–1, history has shown that premature fielding of equipment can be costly and can adversely affect readiness.

Considering the status of M–1 logistics support development, the current testing results and the potential adverse effects on readiness, we believe great care should be exercised in deciding whether the M–1 is ready for full production and fielding in Europe. We have recommended, therefore, that the Secretary of Defense provide the key congressional committees with specific information on how it arrives at the full production and fielding decisions and disclose the potential consequences of proceeding with these actions or delaying them.

Because of the Army's emphasis on having the tank meet unit cost goals and the lack of attention to logistics support development early in the M–1 program, many potential life cycle cost reductions are no longer available. However, we believe DOD can still achieve some savings on M–1 support costs by implementing certain equipment design and logistics support alternatives, which are discussed in greater detail in our report; increasing support for M–1 reliability and maintainability improvement programs; implementing alternative strategies for procuring M–1 spare and repair parts; and reevaluating the number of M–1's planned for training purposes.

Our report contains a number of specific recommendations designed to encourage the Department of Defense to take steps to achieve these savings. In commenting on our report, DOD said it agreed with our major recommendations and was taking numerous steps to resolve or minimize the impact of the problems on the M–1 tank, as well as to improve logistics support planning for future systems. Thank you.

[The prepared statement of Mr. Horan follows:]

PREPARED STATEMENT OF DONALD J. HORAN

Mr. Chairman, we are pleased to appear before your Committee to discuss our recent report entitled "Logistics Planning For the M–1 Tank: Implications For Reduced Readiness and Increased Support Costs" (PLRD–81–33, July 1, 1981).

We initiated our review in response to broad congressional concern that, although support costs for weapon systems have been drastically increasing, recently fielded systems are not achieving required operational readiness goals. The digest of our report is Attachment A to my statement.

Since the status of M–1 testing and development has already been discussed, I would like to highlight some other important issues related to our work on the M–1 tank.

1. The nature and causes of problems the Army experienced in developing logistics support for the M–1 and recent DOD initiatives to avoid similar problems on future systems.

2. Readiness implications of the upcoming September 1981 decision of fielding the M–1 in Europe.

3. The current status of the Army's efforts to develop logistics support for the M–1.

4. Opportunities that still exist to reduce M–1 logistics support costs.

PROBLEMS WITH DEVELOPMENT OF M–1 LOGISTICS SUPPORT

The pressures to attain specific performance goals (such as surviviability, speed, range and fire power) within tight time and acquisition cost restrainsts led Army management to give inadequate consideration to the development of M–1 logistics support and long-term ownership costs. For example:

It was decided not to fund integrated logistics support development during prototype competition. Instead, it was planned that low-rate initial production

would provide sufficient time for development of logistics before large quantities of tanks were fielded.

While the Army believes the M-1 has been the most tested combat vehicle in its history, prototypes were not available when needed to design and test logistics support.

Program requirements and testing have been directed primarily at seeing whether the tank can achieve established performance goals.

As a result, the development of logistics support lags behind the tank's development. This is critical because current M-1 program milestones call for decisions this September on whether to authorize full production and to field the M-1 in Europe. In the last few months there have been several DOD initiatives aimed directly at some of the causes of the M-1's problems. A recent example is a June 13, 1981, memo providing guidance on improving the DOD acquisition process, in which the Deputy Secretary of Defense reemphasized that "improved readiness is a primary objective of the acquisition process of comparable importance to reduced unit cost and reduced acquisition time." Also, readiness goals—that can be quantified in terms of hardware reliability and maintainability and manpower and logistic resource requirements—will be established early in a weapon system's development and will be used as a principal management tool.

These actions are highly commendable. If aggressively implemented, they should help prevent problems similar to the M-1s from occurring in future systems.

READINESS IMPLICATIONS OF FIELDING THE M-1

In September the Army and DOD plan to determine whether the M-1 is ready for fielding to Europe. In our opinion, great care should be exercised in reaching this decision because there are already tank support problems in Europe that could become exacerbated by premature fielding of the M-1.

Army officials have stated that from a user's perspective the M-1 tank "even at its current configuration and reliability level, has more operational utility and combat effectiveness than the current main battle tank." But we believe this has to be weighed against the potential consequences of early fielding of the M-1.

While it is impossible to predict the consequences of a decision to go ahead and field the M-1, history has shown that premature fielding can be costly and can adversely affect readiness. For example, the M-60A2 tank was deployed to Europe in 1974 with hardware design problems and inadequate logistics support (trained personnel, test equipment, spare parts, and technical manuals), which resulted in high support costs and a general reputation as an unsupportable tank. Similar logistics support problems currently exist for the M-1.

Some of the logistics support problems currently affecting the M-60s in Europe would be exacerbated by fielding the M-1 at its current level of logistics supportability. For example:

The M-1 will use 30 to 90 percent more fuel than the M-60, but there are already too few petroleum supply vehicles and inadequate fuel storage facilities in Europe.

Problems with transportation and storage of ammunition will be aggrevated because the M-1 carries fewer rounds and therefore needs more supply vehicles. Also when it begins using the 120-mm. round instead of the 105 mm. round, additional storage space (which is already inadequate) will be needed.

Other areas where the M-60 is experiencing logistics support problems—such as retaining personnel with critical skills, outdated and inadequate maintenance facilities, and a general shortage of trucks—would likely be further strained by early fielding of the M-1.

Also, if an immature system is fielded, additional costs are likely for such things as (1) extensive contractor support, (2) additional spare parts or other equipment, (3) special procedures to work around the unavailability of support equipment, and (4) added transportation and retrofit costs.

STATUS OF LOGISTICS SUPPORT FOR THE M-1

The early emphasis on fielding a tank within a 7-year development cycle heavily influenced the Army's decision to move the program forward and meet specific program milestones. For example, in an early 1979 report, the Army's Logistics Evaluation Agency stated that logistic elements trailed end item tank development so much that extended engineering development would be required to catch up. Also, the report pointed out that the end item tank status was such

that extensive engineering development would be required to demonstrate mission reliability, maintenance burden, and power train durability thresholds.

At that time the Logistics Evaluation Agency recommended that the M–1 program remain in full-scale engineering development and that the Army verify correction of deficiencies identified during phase II testing before making a production decision. However, despite these deficiencies, the Army and DOD review councils recommended that the M–1 program proceed from the engineering development phase to the production phase.

Not only has M–1 logistics support development lagged behind the tank's development but the scheduled completion dates for various support needs are still several years away. (See attachment B.)

In February 1981, however, the Army concluded that "the tank is supportable in the *near-term* considering the relatively *low production* rate and *intensive management* of logistics issues." (Emphasis added.) The Army also concluded that the majority of M–1 development was reasonably complete, support planning was sufficiently mature, and remaining development items could be completed without undue risk to M–1 readiness. Given the status of M–1 logistical development and current testing results, these conclusions seem overly optimistic.

Because of our concerns about the status of M–1 logistics development, testing results, and readiness implications, we have recommended that the Secretary of Defense provide key congressional committees with the information DOD uses to arrive at its full production and fielding decisions and to quantify the potential consequences of proceeding with these actions or delaying them.

OPPORTUNITIES TO REDUCE M–1 LOGISTICS COSTS

While the supportability and fielding issues are paramount, there are also some opportunities for DOD to reduce M–1 support costs. Because of the emphasis on design-to-unit-cost criteria and the lack of attention to logistics development early in the M–1 program, many potential life-cycle cost reductions are no longer available. However, DOD can still achieve some savings by:

Implementing some M–1 equipment design and logistics support alternatives which could reduce costs without affecting readiness,

Increasing support for M–1 reliability and maintainability improvement programs,

Implementing alternative strategies for procuring M–1 spare and repair parts, and

Reevaluating the number of M–1s planned for training purposes.

EQUIPMENT DESIGN AND LOGISTICS SUPPORT ALTERNATIVES

As discussed earlier, many decisions were made based on what was cheaper to initially acquire rather than what would be cheaper in the long run. For example, the state of the art in wiring harnesses is the convoluted cable, which is being successfully used by the British Chieftan and other foreign-made armored vehicles. But Chrysler and Army officials said that convoluted cables were rejected for the M–1 because of their high initial acquisition costs.

Army Armament Material Readiness Command studies in 1979 concluded that the M–1 wiring harnesses were not as effective as the convoluted cable. The Command also studied the potential savings of substituting the convoluted cable for 1 of the 60 harnesses in an M–1 and concluded that for the M–1 fleet more than $18 million could be saved over its 20-year life. Because each harness on a tank is subject to various wear and usage factors, we do not know how many of the 60 M–1 harnesses should use convoluted cables nor can we estimate the total potential savings by using convoluted cables. However, we believe the Command's study demonstrates that potential savings are substantial. Therefore, the use of convoluted cables and other decisions made because of the design-to-unit-cost rather than life-cycle-cost criteria should be reevaluated.

M–1 RELIABILITY AND MAINTAINABILITY IMPROVEMENT PROGRAMS

Recognizing that the future impact of logistics support costs has not received adequate consideration, the Army is now identifying areas where reliability and maintainability improvements are needed and establishing programs to accomplish these improvements. For fiscal years 1981–83, $87 million has been programed for such improvements. However, the Army said increased funds will be required to fully realize the potential M–1 life-cycle cost reductions suggested in our report.

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ALTERNATIVE STRATEGIES FOR PROCURING SPARE AND REPAIR PARTS

Primarily because the needed data was not available, the Army was generally unable to use standard systems for determining initial requirements for M–1 spare and repair parts. The systems that were used to determine needs for the first 3 years of production resulted in the purchase of parts which may greatly exceed requirements for that period. Furthermore, because of continuous engineering design and tank production changes, many of the spare parts procured may become obsolete before they are needed. We recommended that DOD reevaluate M–1 requirements and delivery schedules for spare and repair parts considering such things as changes in M–1 design, maintenance plans, and tank production schedules, and more recent data on parts failure rates.

In addition, we recommended that DOD adopt alternative procurement strategies that could ensure that future spare and repair parts are procured using the most cost-effective methods available. DOD agreed to review alternative procurement strategies and to implement them where readiness and cost effectiveness can be enhanced.

M–1 PLANNED FOR TRAINING PURPOSES

The Army's plan to buy 348 M–1 tanks for training at a cost of $887 million seems excessive given (1) the low use being made of training M–60s on which M–1 training needs were based and (2) the potential use of training devices which could substitute for M–1s.

We were unable to identify firm criteria on how much usage training tanks should receive. However, our analysis of data on the extent to which M–60 tanks were being used for training at the Army's primary tank training center, Fort Knox, indicated that training needs could be satisfied with about 73 percent of the tanks on hand. If planned purchases of training M–1s could be similarly reduced, 96 M–1s valued at $245 million would not be needed for training purposes. In addition, the Army plans to spend over $250 millon for training devices which could further reduce the need for training M–1s. In response to our report, DOD has begun a reevaluation of the number of training tanks used in the M–60 program and the number projected for the M–1 program.

Mr. Chairman, we will be happy to respond to any questions you may have at this time.

ATTACHMENT A

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS—LOGISTICS PLANNING FOR THE M–1 TANK: IMPLICATIONS FOR REDUCED READINESS AND INCREASED SUPPORT COSTS

DIGEST

The M–1 tank, the Army's new main battle tank, was designed by the Chrysler Defense Division and is being produced in the Army's Tank Plant in Lima, Ohio. On the basis of the Army's projection of a 7,058–M–1 fleet, acquisition costs are currently estimated at $19 billion—$2.5 million for each tank. This figure includes research and development and production costs, but does not include the anticipated costs of operating and supporting the M–1 over its 20-year projected life cycle.

Integrated logistics support planning—the approach to weapons system development which attempts to link development and production to deployment and operation—has not been adequate or timely for the M–1 tank program. Although recent planning efforts have improved, many supportability questions remain. Also, opportunities exist to reduce M–1 support costs.

M–1 program emphasis, as supported by the Congress, has been on achieving established design-to-cost objectives and fielding a tank within a 7-year development cycle. As a consequence of this program momentum, there was little early emphasis on logistical support and life-cycle cost issues. For example:

It was decided not to fund integrated logistics support development during prototype competition between Chrysler and General Motors. Instead, it was planned that low-rate initial production would provide sufficient time for supportability to mature before large quantities of tanks were fielded.

While the Army believes the M–1 has been the most tested combat vehicle in its history, prototypes have not been available when needed for designing and testing logistical support.

Program requirements and testing have been directed at inherent tank design performance, and the development of logistics supportability lags far behind the tank's development. The Department of Defense (DOD) and the Army recognize the need to more thoroughly evaluate M-1 operational support characteristics and improve supportability. For example, the Army has proposed over $200 million for design improvements in reliability, availability, maintainability, and durability, but the Army's proposal has not been fully funded.

ONGOING M-1 TESTING MAY NOT PROVIDE INFORMATION NEEDED FOR SOUND DECISIONS OF FULL PRODUCTION AND FIELDING

Supportability questions, still to be answered, include:

Can the M-1 tank be operated and supported in a realistic operational environment at acceptable levels of operational readiness?

Have reliability, availability, maintainability, and durability requirements been achieved or are they achievable?

What will be the operation and maintenance costs associated with the M-1—considering currently demonstrated levels of reliability?

Have sufficient quantities of required logistics support resources been identified and acquired?

Has the M-1 maintenance concept been fully evaluated and has the required number of personnel been identified and trained?

DOD's ongoing operational and developmental M-1 testing (scheduled for completion in May 1981 and January 1982, respectively is supposed to provide the data needed to answer such questions on operational supportability. However, GAO believes that emerging results from current testing raise serious doubts that the M-1 will be proven supportable before full production and fielding decisions are made in September 1981. GAO is concerned that the past momentum of the M-1 program will push the program forward, even though many supportability issues remain.

DOD believes the M-1 is supportable in the near term, considering the relatively low-production rate and intensive management of logistics issues. DOD also believes that current testing will provide adequate supportability information on which to base a sound full production and fielding decision at the scheduled System Acquisition Review Council meeting in September 1981.

GAO believes that improvements can be made in evaluating test data to better measure supportability and provide better data on which to base upcoming production and field decisions. Also, because of past congressional concern regarding M-1 supportability and the potential that insufficient data will be available to support the upcoming M-1 program decisions, the Congress should be provided the information DOD uses for these decisions. (See p. 38.)

M-1 SUPPORT COSTS CAN BE REDUCED

While there are still supportability issues to resolve, DOD has opportunities to reduce M-1 life-cycle ownership and support costs, which are projected in the billions of dollars. The following are possible opportunities.

Since the Army considered acquistion costs, as opposed to total ownership costs, in developing the M-1, the contractor was encouraged to select systems, components, and parts based upon initial procurement costs. The contractor rejected components that would initially be more expensive but which would be cheaper over the tank's life because of improved reliability or maintainability. (See p. 18.)

In support of proposed M-1 fielding requirements for the first 2 years, the Army has spent over $400 million to procure spare and repair parts. Delays in tank deployment and reductions in initial tank productions will reduce initial spare and repair parts requirements and continued modification of various tank systems may make many parts obsolete before they are needed. (See p. 61.)

Army plans to buy 348 M-1 training tanks, costing over $887 million, appear excessive given the low use of M-60 training tanks and also the planned expenditure of $250 million to acquire M-1 training devices. The reduction of tanks at training activities could allow earlier distribution of tanks to operational units. (See p. 70.)

RECOMMENDATIONS

Because of the need to demonstrate the M–1's supportability, GAO recommends that the Secretary of Defense direct the Secretary of the Army to:

Establish additional criteria, at the system and subsystem levels, for evaluating tests that place greater emphasis on operational effectiveness measures and assessments of future support costs. This criteria should include goals and thresholds for logistics burden and operational availability. (See p. 38.)

Quantify and evaluate the potential impact (in terms of increased support and retrofit costs, reduced operational readiness capability, etc.) of producing and fielding the M–1 with currently demonstrated levels of reliability, availability, maintainability, and durability. (See p. 38.)

Reevaluate current M–1 program plans for increasing production capacity, monthly tank production goals, deployment to Europe, and acquisition of long lead production items and spare parts, considering the current level of design maturity of the tank and its support system, tank production and quality control problems, and other factors. (See p. 38.)

Increase support for the development, acquisition, and evaluation of required logistics support capability (for example, maintenance capability, test equipment, and technical manuals). (See pp. 47 and 59.)

GAO also recommends that the Secretary of Defense provide key congressional committees with information on the M–1's logistics burden and quantify (in terms of increased maintenance costs and reduced operational readiness) the impact of fielding the M–1 system at its current level of maturity or delaying the program. (See p. 38.)

To reduce potential life-cycle costs of the M–1, GAO recommends that the Secretary of Defense:

Increase support for M–1 reliability and maintainability improvement programs, recognizing the potential to increase operational readiness and decrease future operational support costs through implementation of an effective life-cycle cost reduction program. (See p. 23.)

Direct the Secretary of the Army to implement alternative procurement strategies to ensure that future spare and repair parts are procured using the most cost-effective methods consistent with the level of maturity of the tank and required technical data. (See p. 69.)

Direct the Secretary of the Army to reevaluate the number of training tanks used in the M–60 program and projected for the M–1 program and to reallocate M–60s and reduce the projected purchase of M–1s or reallocate them to operational needs. (See p. 76.)

Other specific recommendations appear on pages 23, 47, 59, and 76.

AGENCY COMMENTS

DOD concurs with GAO's major recommendations. (See app. IV.) DOD said that numerous steps are being taken to resolve or minimize the impact of the problems discussed. According to DOD, adequate supportability testing information, as well as results of actions described in response to the GAO report, should be available as a sound basis for a full production and fielding decision in September 1981. In this decision process, DOD says appropriate weighting will be given to all elements of the M–1 system's performance.

The Army says it is committed to proceeding with M–1 production buildup and deployment plans while recognizing the near-term potential for supportability problems. The Army anticipates some problems and is developing ways to minimize them until the problems are successfully resolved.

GAO's analysis of DOD and Army comments are included in each report chapter.

ATTACHMENT B

STATUS OF M-1 LOGISTICS SUPPORT DEVELOPMENT, APRIL 1981

	Date scheduled to—		Date competed	Date scheduled for completion
	Begin	End		
Conduct validation of technical manuals.	February 1977	November 1980	Incomplete	February 1981 to November 1982.
Conduct physical teardown and maintenance evaluation.	Not originally scheduled		March to May 1978	
Conduct maintenance evaluation	December 1976	December 1979	Incomplete	1982.
Submit technical documentation	June 1978	November 1979	Incomplete. Baseline established as of September 1979.	Must be continually updated as the tank configuration changes.
Verify support and test equipment capability.	March 1978	September 1979	Incomplete	
Prepare depot maintenance support plan.	June 1979	May 1980	do	
Develop and submit final requirements for maintenance staff hours.	December 1976	November 1979	do	June 1981 or after completion of phase III tests.
Prepare depot maintenance work requirements.*	June 1979	November 1980	do	1982 to 1984.
Perform pilot depot overhaul	December 1980	March 1981	do	February 1983 to December 1984.
Develop full Government depot capability.		do	do	Anniston Depot, 1983; Mainz Depot 1986.
Conduct final verification of personnel requirements.	June 1979	November 1979	do	Final personnel requirements submitted but not approved.
Field M-1 training devices	May to September 1980.		do	July 1981 to 1986.

* Although the original M-1 maintenance concept called for full organic depot maintenance capability before initial fielding in Europe, delays in depot support planning resulted in the necessity for contractor depot support of key M-1 systems and components.

Senator PROXMIRE. Thank you, gentlemen. In responding to my questions, I suggest that you decide who would be most appropriate, because your testimony overlaps somewhat and your jurisdiction overlaps. Maybe you'd both like to respond, or perhaps just one of you.

RAM-D AND POLICY IMPLICATIONS OF M-1 TANK

Before we get into the statistics and the reasons for the disappointing results of the 1981 tests, I would like to address the larger policy implications. The M-1 has more mobility when it is operational, that is, when it is operating, than the M-60 and is superior in that regard. But aren't you also saying that because the M-1 breaks down so often and has such a poor reliability record, it could be inferior to the M-60 under battlefield conditions?

Mr. HORAN. Yes, sir; that's the implication of the logistics support problems that we've identified. If the tank does not operate when it's needed or as often as it's needed, that certainly has a direct bearing on readiness.

Senator PROXMIRE. As I calculated, and correct me if I am wrong, the M–60, which is the present tank that we have, the older tank, the M–60 in present dollars would cost about $1.25 million, and the M–1, the new tank, would cost twice that much, $2.5 million. Would it be fair to say that we may be getting an inferior tank in combat conditions, while paying twice as much for it?

Mr. SHELEY. It's a little hard to generalize quite to that point, Senator. We are paying twice as much. We're getting a tank, as you pointed out very carefully, when it does perform it's a very high performer. The real question is whether it can be made reliable and durable. If so, we've got a fine machine. If not, we've got a lemon, just plain and simple.

Senator PROXMIRE. Those breakdowns, though, are absolutely critical. Isn't that why the progressive decline in reliability at the Aberdeen tests, on the average of 30 to 32 miles between stops for unscheduled maintenance, is so much worse than——

Mr. SHELEY. Very much so, sir. The reliability hasn't declined nearly as much as the durability of the power train. That is the one I think is very crucial. You won't move at all without that power train. Some of the other breakdowns in reliability are less crucial; you can operate with some systems not operational.

Senator PROXMIRE. Explain to us a little bit about that power train. Why is it so significant?

Mr. SHELEY. That is the turbine engine, the transmission and the final drive mechanism. That's what propels the tank in the field. That is the heart of that tank as far as moving it is concerned.

Senator PROXMIRE. That's the heart of the tank, and it's also the heart of the maintenance problem?

Mr. SHELEY. It's the heart of the durability problem; yes, sir.

Senator PROXMIRE. Is it possible that fielding the M–1 tank in Europe, before these problems are corrected, could reduce or perpetuate the present low level of readiness of our NATO forces? Explain how that might occur.

Mr. HORAN. Yes. As pointed out in our report, we do see a strong possibility that this would occur. We already know, and the Department of Defense is well aware, of serious support problems with our troops in Europe. Some of them are discussed in our report. But I can list a few.

Some of the more serious ones involve shortages of fuel and ammunition trucks. These are trucks that would be required to transport fuel and ammunition from the storage points up to where the tanks would actually be operating in a combat environment. There are already sever shortages of trucks in Europe now; and with a tank that will use even more fuel, this problem could become even more severe, and have a greater impact on readiness.

Senator PROXMIRE. How about the problem of training and retaining competent mechanics and people who are able to maintain these tanks? Is that a problem?

Mr. HORAN. This is also a problem now, and it will continue to be a problem. There are shortages of mechanics and people with the kinds of skills to keep the M–10 tanks operating properly now. And with a new tank they could have even different problems, if not

more frequent problems. The training and skill level problems we're having now could be even more severe. So we are concerned about that.

Senator PROXMIRE. Would you say that fielding a new weapon that's excessively difficult to maintain and support could make it necessary to withdraw the weapon from the field?

Is this what happened with the M–60A2 tank, and could it happen with the M–1?

Mr. HORAN. I believe there are other problems besides the maintainability problem with the M–60A2, but they did have severe support problems.

There are a lot of things that the Army can do to overcome maintenance problems with the equipment. It's difficult. It takes a lot of innovation. And it's very costly. But with strong, intense management of the problem, they can probably keep the tank operating sufficiently.

Senator PROXMIRE. How much did the M–60A2 tank cost?

How many were taken out of Europe?

What will the Army do with them now?

Mr. BARAS. The latest cost figures we obtained were $717,000 per tank for production of 543.

Senator PROXMIRE. What does that add up to?

Mr. BARAS. The total program cost?

Senator PROXMIRE. What is the total cost? That was my question.

Was it about $600 million? $700 million? Something like that?

Mr. BARAS. About $700 million.

Now, the Army is estimating that it costs about $6,000 per tank to withdraw the tanks from Europe and to bring them back.

Senator PROXMIRE. What will the Army do with them, now that they've brought them back?

Mr. BARAS. They're going to be converted to an M–48A5 configuration.

Senator PROXMIRE. What will that cost?

Mr. BARAS. We don't have that figure.

Senator PROXMIRE. And how long will that take?

Mr. BARAS. We don't have that information.

Mr. SHELEY. We'll have to get that information for you.

Senator PROXMIRE. Will you get that information? Because I said in my statement that they might be useless. Maybe that's an overstatement.

[The following information was subsequently supplied for the record:]

The M–60 Project Manager has only been directed to do the engineering effort required to investigate the feasibility of mating an M–60A2 chassis and an M–48A5 turret. If the resultant conversion is approved and the hardware kits procured in fiscal year 1983, the costs, as estimated by the M–60 program office, would be $74.9 million for 540 sets or, a unit cost of $138,704. These funds would be chargeable to the WTCV procurement appropriation.

Funds required for engineering and conversion during fiscal year 1985–fiscal year 1987 are $90.7 million or a unit cost of $167,963. These funds would be chargeable to the OMA appropriation.

Thus the total cost for the conversion of 540 tanks would be $165.6 million or a unit cost of $306,667.

Senator PROXMIRE. Do you have any notion of how long it would take to repair them?

Mr. BARAS. To overhaul them?

Mr. SHELEY. I think we can get that information for you, Senator, and submit it for the record.

Mr. HORAN. Senator, I believe the Department of Defense is still in the option stage here. I don't believe a firm decision has been made to convert these. They are examining a number of options. I'm told some will be to convert them to—well, there are several other conversion possibilities that are being considered, in addition to converting them to the M–60A3's.

Senator PROXMIRE. Now, the really shocking thing about your testimony is that the 1981 test results are in some ways more disappointing than the earlier tests.

Using that chart, state whether the M–1 met the Army's reliability, durability, and maintainability goals.

And are performances different between 1981 and the earlier tests?

Mr. SHELEY. Senator, the raw data would indicate that they didn't meet any of those goals.

Senator PROXMIRE. They didn't meet the reliability? They didn't meet the durability? They didn't meet the maintainability? None of them?

Mr. SHELEY. Not when you look at all the tanks tested.

But some of these raw test data will probably improve some by the end of the final scoring conference. Some of the problems will have been solved, and that will permit them to make a little better picture on it. There's the possibility that reliability and maintainability could meet the goals, but the durability—we are very pessimistic that anything they can do to that, manipulation of figures or anything, could get to the point of the 50 percent durability goal.

Senator PROXMIRE. Is it really going to be improved?

Or is the data going to be manipulated?

Mr. SHELEY. No. In some cases, for example, a problem that's identified and may be included in our raw data, may have been solved during the testing program.

I'll identify one of those; that is, the clutch in the transmission. Now, if that problem is in fact solved, and some tests indicate that it may be, then it would not be appropriate to tag that as a maintenance or reliability failure on the final test result.

Senator PROXMIRE. As I understand, the tests demonstrate what's wrong, and you have to have a new test, to determine whether or not you were able to correct it.

Mr. SHELEY. That's correct, sir. That is right. And with regard to the clutch, that has been done.

Senator PROXMIRE. But you can't improve the data until you have the new tests.

Mr. SHELEY. That's correct. That's right. Now, the test has been run on the clutch, and it appears that it has been solved. If that is the case, then those prior failures—all of this data is cumulative, keep in mind this is cumulative, Senator, the whole test period. So, if we've got a problem that happened early on, that has now been solved, it is no longer a reliability problem.

Senator PROXMIRE. Let me just ask you the general question. I think you've answered it in part, but I'd like you to address yourself to the whole question.

How significant is it that the Army has not met these goals?

Is this something that should be expected at this stage of the program, or is it a special cause of concern?

Mr. SHELEY. I think it's a cause of concern at this point.

Senator PROXMIRE. It is a special cause of concern?

Mr. SHELEY. Yes, sir.

Senator PROXMIRE. Particularly with respect to, you said——

Mr. SHELEY. Durability.

Senator PROXMIRE. You emphasized the fact that the power train durability declined from the previous test. Why is this significant?

Mr. SHELEY. Well, there had been some idea that some of the problems had been fixed earlier. There was a blue ribbon panel report which indicated that some of the problems were being taken care of and yet, despite all of this, the whole year in which to improve this—the durability of that engine—it has gone downhill again. It has just not met the goals.

Senator PROXMIRE. Now, in your prepared statement you say that the Army, in keeping score of the tests, throws out mishaps due to crew error, accidents, and the like. And if you include these mishaps, then the tank's average is only about 31 miles between stoppages for unscheduled maintenance.

Doesn't this mean that the Army's official scores don't tell the whole story and, in that respect, are misleading?

Mr. SHELEY. You have to put them in the proper context. I would agree with you that a tank that is damaged in an accident is a tank out of action. There's no question about that. With regard to the crew-caused problems, they are learning to operate the tank. I wouldn't be quite so concerned about that one. The less than 30 minutes repairs is another question. It's a judgment call, I think, as to how significant that might be.

Senator PROXMIRE. Now, looking at the M–60A1 test results, it appears it did better in this test than the M–1, in most categories.

Mr. SHELEY. That is correct, sir.

Senator PROXMIRE. What do you conclude from these comparisons?

Mr. SHELEY. You'd have to take into consideration that this is a whole new concept in a tank power train system, the M–1, the first adaptation of a turbine engine to a tank. The diesel engine is a much more mature engine, and very stable. The type of problems in a power train you would not expect to have with the diesel, since it's been in use for many years, as you would have on a turbine. That's part of the problem.

Senator PROXMIRE. The vice chairman of the full committee, Senator Jepsen, is here; and Senator Symms is here, too. I would be happy to have them come in. I do have some other questions I would like to ask at this time.

If you would like to take a minute or two before we go ahead, Senator Jepsen.

All right. OK.

Can you site other examples of systems that have not achieved prior operational readiness goals because of poor reliability, breakdowns, and support problems?

Mr. HORAN. The F–14 and the F–15 are some recent examples. And in a report that we put out in January, we had an appendix

listing a series of weapons systems and other equipment that has been fielded recently, that have experienced some reliability or maintenance support-type problems. We can provide that for the record.

Senator PROXMIRE. I would appreciate it.

[The information referred to follows:]

APPENDIX V[1]

EXAMPLES OF MILITARY EQUIPMENT REPORTED BY THE SERVICES TO BE UNDEPENDABLE AND DIFFICULT TO SUPPORT AND OPERATE

System/equipment	*Problem*
ARMY	
TOW (Antitank missile system, ground version).	Battery power supplies were unreliable. As a result, missile launches were jeopardized or guidance was lost during flight.
Dragon (antitank missile system).	Component malfunctions plus human factor problems cause many of these missiles to miss the target.
T142 tank track on M–60 series tank.	This track must be replaced at 1,500 to 2,000 miles. It is less reliable than it's predecessor.
AH–1 "Cobra" attack helicopter.	The main rotor hub has significant reliability problems due to frequent failure of feathering axis bearings.
GOER (transport/resupply vehicle).	Extreme bounce generated by vehicle produced serious driver fatigue. Numerous components suffer high rates of failure.
M–110 self-propeller howitzer (8 inch).	Numerous hydraulic components problems being experienced since recent modifications added a heavier gun tube, Additional problems exist with road wheels, overheating engines, gun sighting equipment, and projectile ramming systems.
Test and diagnostic equipment used for avionics and electrical subsystems.	Equipment is unreliable, requires extensive calibration, and is difficult to repair.
NAVY	
MK–86 gun fire control system on many surface warships.	A significantly large number of random failures among the 40,000 plus parts and the inability of supply system to meet these replacement component demands have caused low operational availability.
AN/SPG–55B guided missile control radar on many surface warships.	Low reliability, replacement part shortages, and inadequate operator and maintenance training are affecting operational availability.
AN/SPS–40 air search radar on many surface ships.	High failure rates of some parts, long time to receive replacement parts, and inadequate number of trained technicians lead to operational availability problems.
Wasteheat boilers on DD–963 class destroyers.	Extremely difficult, if not impossible to adequately maintain. Equipment failure would result in partial loss of ship's electrical power, potentially affecting ship's weapon systems.
BQQ–5 sonar on SSN–688 class attack submarines.	Severe replacement part shortages have caused submarines to experience mission degradation.

[1] See footnote at end of table.

NAVY

System/equipment	Problem
MK-18 periscope on SSN-688 class submarines.	Fleet has experienced many problems including (1) slip ring failures, (2) poor logistic support, (3) inadequate technical documentation, (4) inadequate maintenance training, and (5) insufficient technical support equipment.
S-3A antisubmarine warfare aircraft.	Low reliability of many key electronic components have caused low aircraft operational availability rates.
AIR FORCE	
"Turkey Feathers" on F-15 aircraft.	These engine parts are wearing out after about 15 hours of use. They cost $1,000 each, and each aircraft has about 30 of them.
F-100 engine in F-15 aircraft.....	Problems with reliability and durability, particularly in the "hot section" of the engine, have led to low operational availability rates.
Automatic test equipment for F-15 aircraft.	Problems include (1) lack of adequately trained and experienced operators and maintenance personnel, (2) some software incompatability, and (3) low reliability of the built-in test and avionics intermediate shop automatic stations. These problems degrade testing efficiency and ultimately degrade aircraft's operational readiness.
Stability augmentation system in A-10 aircraft.	Problems with targeting on the first 201 aircraft and with vibrations and signal interruptions on the last 158 aircraft affect the aircraft's mission effectiveness.
Flight controls in A-10 aircraft....	Clearance for the aircraft cables and controls is not sufficient, and foreign objects may jam the controls. This condition may already have contributed to aircraft accidents.
Shelters for A-10 aircraft.....	Serious shortage of shelters in Europe might adversely affect maintenance of aircraft.
War reserve spare kits/base level self-sufficiency kits.	Shortages of war reserve replacement parts and components exist. These kits are needed to keep aircraft and their subsystems operational.

[1] From GAO report entitled "Effectiveness of U.S. Forces Can Be Increased Through Improved Weapon System Design," PSAD-81-17, Jan. 29, 1981.

Mr. SHELEY. We looked at about 30 systems at that time, sir, that had problems.

Senator PROXMIRE. The GAO's M-1 report for uses on the Army's failures in logistics planning and decisions by the Army and Chrysler to buy equipment that is cheaper, but that will break down and be more costly in the long run.

Is this an isolated case, or has this happened before?

And is it a major reason why the Pentagon has not achieved prior operational readiness goals, despite the fact that support costs are increasing?

Mr. HORAN. We don't think this is all that unique. I think there's a growing recognition by the Department of Defense—and it's illus-

trated in some recent pronouncements that have come out—that not enough attention has been given to the logistic support and the readiness implications in making decisions to move ahead on weapons systems in the past.

The recent memorandum by Mr. Carlucci—in June, I believe it was, June 13—indicated that the Department now wants to give logistics and readiness an equal priority with the acquisition costs and delivery schedule, and make sure that that is not considered as a subordinate objective. Whether this will be carried out——

Senator PROXMIRE. You're 100 percent right in that. But what steps, if any, have they taken to make that a reality?

Mr. SHELEY. They have reemphasized this. It's a little early to tell how effective it's going to be. But they reissued all of their major acquisition directives not too long ago. For the first time there were several things brought into those pronouncements that we were very encouraged by.

One is affordability of systems; up front, making a decision as to the affordability. The second one was the logistics and manpower items that go into the design of a system have to be in there. Until such time as the project manager's report card is changed, and he's graded on the effectiveness of a system that goes to the field, not on meeting costs, schedule and performance critieria, it's going to be difficult to get that built in. But I see the emphasis coming through OSD now and we're hopeful that they will maintain that momentum. Some of the problems with some of the systems that are now in the field should be minimized in future systems, if they will truly adopt that up-front commitment to design systems that are operable and are maintainable.

Senator PROXMIRE. Let me just ask a couple more questions, and then I'll yield.

Is there a logistics support problem with our current main battle tank, the M–60A3?

You discussed the problem with reference to maintenance trucks, repair sets, spare and repair parts, technical manuals, trained mechanics, fuel and petroleum products, and ammunition.

Mr. HORAN. Yes, sir. Those are problems currently occurring in Europe with the M–60. It's not too much of a problem in terms of keeping the M–60's operating. I think sustainability is a problem, in terms of keeping them operating for a period of time. If you do have a combat situation, where you have to operate the equipment in a high, very intense combat environment, over a period of time there are serious problems with the ability to keep the tanks moving.

Senator PROXMIRE. When you put this whole situation together, doesn't it make it really even more difficult?

Let me put it this way: Isn't the Army fielding, along with other items of complex advanced technology systems, along with the M–1, such as the infantry fighting vehicle, the Roland missile, AH–64 helicopter, the multiple-launch rocket system, the Patriot air defense system—and won't the combined effects of all these systems multiply this important problem?

Mr. HORAN. It seems to stand to reason that that would cumulatively have that sort of effect, and support problems would become

more severe than they currently are. We haven't really done a study that would show the cumulative effect of this, but it just seems to make sense.

Senator PROXMIRE. We seem to be overwhelmed by this marvelous technology. It has a big potential, and it should give us, normally, great advantages. But somehow, coordinating it, putting it together, maintaining it, using in intelligently is a challenge that we just haven't met.

Senator Jepsen.

Senator JEPSEN. Thank you, Senator Proxmire.

I am a member of the Joint Economic Committee; I am also a member of the Armed Services Committee. It's of great concern to us, not only with the M–1 tank, but anything that we procure. Those in the developmental stage leave a lot to be desired. And it seems, from time to time to a lot of us, why they can go so long without correcting some of the problems that they've had.

So, before asking questions, let me assure you, Mr. Sheley, that I and my colleagues, as late as yesterday afternoon, discussed at great length the M–1 tank. We discussed the progress, the lack of progress. We discussed the question that has yet to be answered, and that is How long will they be able to sustain themselves in combat?

None of us want to purchase, pay for or be a party to, under any circumstances, forgetting the economics of it, a tank that, when given to an American fighting person, would let them down in combat. So I think we all as Americans agree on that point.

However, I must say that it does seem that now there's a lot of folks looking for ways to attack the general program of the Reagan administration. And I'm not talking about the GAO now, or anyone here. But defense is a favorite whipping post, and anything that we can find—especially if we can move figures around, and we can compare apples to barn wagons, instead of apples to apples—why, we can come up with all kinds of things.

With that in mind, Mr. Horan, when was the cutoff date for the data used in the GAO report?

Mr. HORAN. December of 1980; and some of it was in January.

Senator JEPSEN. Would you want to comment now on the Army and DOD actions, since we now have a whole new team since this cutoff date?

Mr. HORAN. Mr. Sheley and his crew are actively monitoring the ongoing tests. He's better able to talk about it.

LOGISTICS PROBLEMS

Senator JEPSEN. Would you care to comment, Mr. Sheley, on what actions have been taken to correct logistic planning problems up to the present time?

Mr. SHELEY. That one I cannot answer. I can tell you one thing that they are doing though. Mr. Carlucci's initiatives in the procurement and acquisition area are, we think, very laudable; they're going to be difficult to implement, but we're encouraged so far by the diligence that they're displaying over there. They've made some pronouncements, and this is not new, but there seems to be much more of a desire to follow up and implement these initiatives than I have seen

in past years. So I am encouraged. But it's a little early to tell how effective going to be.

Senator JEPSEN. So the new team is doing something about some of of the problems you're concerned about?

Mr. SHELEY. Yes, sir, it is.

Senator JEPSEN. Keeping it general, this is how you're addressing it—they've been doing a reasonably good job—a laudable job, you said.

Mr. SHELEY. I say the objectives are laudable, and I'm encouraged by the diligence in which they're pursuing the implementation. We have some people on my staff that will be following up on this, monitoring the implementation of the Carlucci initiatives.

Senator JEPSEN. I am glad we established this perspective then so we can launch the rest of our discussion.

RAM–D TESTS

Now, on reliability, availability, maintainability, and durability, that's RAM–D. You continually compare RAM–D data between the M–1 and the new production M–60A1.

Mr. SHELEY. A–3.

Senator JEPSEN. A–3.

Could you compare the RAM–D data for the M–60 and the M–1 at the same point in their respective development cycles?

Mr. SHELEY. The data that we have up here are for new M–60A1 tanks similar to the new M–1 tanks recently tested at Fort Hood. And the M–60A1's were not too far down the development pike beyond where the M–1 is at this point in time, as I recall.

Senator JEPSEN. But in comparing the RAM–D data between the M–60A3 and the M–1, without adjusting or allowing for the same point in their respective development cycles, is that exactly what you call comparing apples and apples?

Mr. SHELEY. No, sir, it is only a gross indicator in this case.

Senator JEPSEN. It doesn't quite come off this way. I'm just trying to straighten the record up here.

Mr. Horan, how can the GAO say that the tank's logistical problems are so severe it cannot be operated in a realistic battlefield environment, when, in fact, the commanders and troops who have just completed the final troop evaluation of the M–1 tank at Fort Hood and Fort Knox for the past 10 months now enthusiastically endorse it?

Now, I don't feel real strongly about that particular question. It's too general in and of itself. But I'll ask it, and let's run it up the flagpole and talk about it.

We have, I think, a Senator who just came back, is that correct, from there?

There are some that just came back a few days ago.

Mr. HORAN. I think the information that we have is that the users are quite enthusiastic about the performance of the tank. The study that we made basically looked at the logistic support for the tank. While it's operating, it seems to do very well and is a big improvement over what's out there now. So the operators are happy, with some causes it appears.

In terms of maintaining the tank and keeping it operating over a long period of time, there are some problems that the test results

hadn't proven to be satisfactory, even in the Army's eyes, at the time we completed our review. In fact, the Army and the Department of Defense, in commenting on our report—they wrote to us April 27—basically, were receptive to the idea that there were serious supportability and logistic support problems of the type that we described in our report. And they, themselves, indicated a very great concern for these things. I think this is reflected in the approach they're taking to the RAM–D test.

Senator JEPSEN. We've gone through the problems with the turbine and the transmission and a lot of other things. Now it seems as though this point that you just addressed is the big remaining question. How long will it last? We don't want to get into combat, as I indicated before, and in 32 hours have something drop off. That needs to be tested.

The only way we feel it can be tested is to continue on with the program, rather than dragging our feet, which is essentially a decision we made in the Armed Services Authorization Committee yesterday.

COST OF DEVELOPING M–1 TANKS

So often we hear again for the record that the per-unit cost of the M–1 has risen from around $500,000 to $2 million. What is the per-unit cost in 1972 dollars, using the same costs used in the 1972 $500,000 figure? I'm asking a question I think I know the answer to.

Mr. SHELEY. I don't have that figure exactly. I'd have to get that for the record, Mr. Jepsen. But I think we have some data on that. But I don't have it with me.

Senator JEPSEN. The information I have is that the cost now would be equivalent, comparing apples to apples, to about $568,000.

Mr. BECKEMAN. That's approximately correct.

Senator JEPSEN. That's a little different than what has been presented to the public.

Mr. SHELEY. Certainly a large part of that growth has been in the area of inflation. There's no question about that.

DEFENSE NEED FOR M–1

Senator JEPSEN. Mr. Sheley, the Congress has been closely monitoring the Army's efforts to design and field a tank to match the Soviets. And they've encouraged the Army to speed up the process. Yet there seems to be some feeling—I hope this is not totally accurate—again the perspective, I may not always have it accurately either—that the GAO says, "Slow it down, and rely on an old tank" that we all know is outmatched by two fielded Soviet tanks and another that should be out before long.

Is there any concern in any of these recommendations that GAO makes with regard to threat and importance of the M–1 being available to help us immediately?

Mr. SHELEY. Absolutely. I think our message may not be coming across exactly. We are not saying necessarily that you slow it down and wait 10 years to get a tank in the inventory. We would stress that you try to solve the problem. And we have recommended that a parallel backup diesel program be instituted. The Congress did

appropriate the money for that, I believe, in 1980. The Army has awarded a contract. We think that's good insurance.

But try to solve the problems of the M–1, because performance-wise it is a good tank. I talked to some of the crews; I was down at Fort Hood during the testing. They're very enthusastic, particularly with regard to its capability to shoot on the move. That is where it really stands out above the M–60 tank.

But they have the reliability-durability problems that have got to be fixed so that we will have the kind of tank that you referred to that we can give to the troops and that they can rely on.

Senator JEPSEN. I want to commend you for your diligence in your work. We need this guidance and this check. And I just wanted to make sure—the perspective, as far as the American people and the basic understanding of my colleagues—that we're all desirous, from what I've heard just in the last few minutes, of the same results, the same goal. And we want to make sure that the converastion and the reports about the M–1 tank are reported accurately and on a positive basis.

Thank you, Senator Proxmire.

Senator PROXMIRE. Senator Symms.

Senator SYMMS. Thank you, Senator Proxmire and Senator Jepsen. I appreciate those of you who are here this morning.

LEAKS TO PRESS

One of the things that always concerns me is that every time we seem to come up with a weapon system that is one that the Soviets don't want us to build that there's always a lot of bad press that gets out about it.

I think about the real tank stopper for the European battlefield would be a neutron warhead. It has received so much bad press that the United States is still in a situation where we don't have the neutron warhead in our front line units in NATO, which I think is very unfortunate, personally. I think we should have it there. Then they can build all the tanks they want. But they pose a minimal threat to anyone, if you have a neutron warhead, high-radiation artillery shell, to be able to pose a real counterthreat to those tanks.

But, there again, this tank appears to be one which could stand nose to nose with the newest, latest Soviet tanks, the T–80 and T–82.

What concerned me—it was brought to my attention that your report was dated July 1 and was delayed in being released to the DOD until July 8. But prior to the official release of the GAO report, the draft report was leaked to the Chicago Sun-Times, the Defense Week Aerospace Daily, and published articles on the report, dated June 28–29 and June 7, respectively.

I'd like to hear an official explanation why this report leaked out, so that the Army gets—probably some criticism is due, but I've never seen anything, whether it was clear back to the P–51, through the Phantom, or whatever, that was ever developed without some wrinkles. That's just the way it works.

The first series of tanks—we're going to make an improvement every time we build more of them, hopefully. And after we've built

more and more tanks, we hope that each series that will be produced will be better and have some improvements in it from the previous series.

But I'd like to have an official explanation of why this report gets out so we get all this bad publicity, which, of course, causes a lot of concern to those of us that represent the taxpayers, as well as the taxpayers themselves.

Do any of you have a comment on that?

Mr. HORAN. Yes, I'd like to comment on that, sir.

The General Accounting Office is very concerned about leaks of draft reports. We take great pride in our ability to try to protect the information until the agency has had an opportunity to comment on a draft and we're able to reflect those comments in a final report. So we do get disturbed when leaks occur.

We have a very tight control over the number and the distribution of the drafts. On February 13 we sent draft copies to the Department of Defense and the Army for them to review and to comment on. Sometime after that date, the newspaper stories started appearing. We don't know the source of the leaks, and we have no way, really, to track that down.

We periodically meet with the Department of Defense people to try to establish with them some kind of better assurance that they will protect the copies that we provide them.

It's awfully difficult, with the number of Xerox machines around and the number of people who have to comment on a comprehensive report of this type, to keep total control over the distribution. But I assure you, it was nothing that the General Accounting Office was responsible for in terms of providing information to the press.

Senator SYMMS. I appreciate that.

COST OF M–1

I do think it's a problem when we find out that the actual cost overrun—if you put it back in 1972 dollars, that the actual cost per copy—in 1972 dollars is $568,000 per copy. It put it in a much clearer perspective.

The reason that all these things cost more is that we run that printing press downtown and print money, and that causes inflation. And then that causes the general price level to go up, as a result of all the monetary inflation that we suffer from in this country. And it doesn't often come through that way to the public.

SURVIVABILITY OF M–1

I'd like to ask another question. In evaluating the cost of the M–1, compared with M–60A3—is it the M–60A3 that you're talking about—don't you think that we have to consider the much higher survivability of the M–1, dealing with antitank weapons? Aren't there some 10 or 15 Soviet antitank weapons that the M–1 can survive that the M–60 can't?

Mr. SHELEY. Certainly. Its overall capabilities are certainly worth extra dollars, and its ability to withstand taking any hit on its armor is a clear demonstration it's superior there, which means that you're going to have more tanks surviving.

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The same with its capability to fire on the run—that's worth something. There are a lot of factors that get into it. You can't just measure dollar for dollar. I guess that's what I'm trying to get across. You have to consider capabilities, increased capabilities. But you can't ignore the fact that you have a maintainability and durability problem with it either. I think that has to be addressed and solved.

Senator SYMMS. How about the comparison? Some have advocated that we revamp the M–60 with the supplemental armor kit. How would the M–60 series, with the new bolt-on armor, compare with the M–1 in terms of survivability?

Mr. BECKEMAN. I'll address that one.

I am told that Teledyne has a proposal to do that and that according to that particular contractor, they claim that the bolt-on armor on the M–60 would do about as well as the M–1. But we have not done any work ourselves on that.

Senator SYMMS. That's Teledyne's report.

Mr. BECKEMAN. They have made a proposal that they can bolt on special armor onto the current M–60's and it will provide the equivalent type of armor protection. They also have a proposal to put a 1,200-horsepower diesel in the M–60 and a few other improvements. The Army, initially, has turned down their proposals.

RAPID DEPLOYMENT OF M–1

Senator SYMMS. Senator Proxmire, I guess I'd just make one closing statement that I would say I would agree with Senator Jepsen. I think the GAO certainly is held in very high regard by many of us in the Congress for the job that you've done over time. But I do believe that there is a real argument in favor of fielding this battletank very rapidly and not allowing for any kind of delay to interfere with it and have a little bit of faith in our ability—in the entrepreneurial ability of American engineers and producers to be able to make corrections in the powertrain and some of the other things as they test these weapons and use them and get some actual operating experience with them.

Anything that happens that would delay and slow down only compounds the cost problem we have. I hope that we can have some positive impact from your report that will be helpful to the Army. But I'd have to say I feel a little disappointed sometimes when all this bad press continually comes out, you know, whether it's the B–1, or whether it's any weapon system that it seems is really going to be an effective one. Those have an awfully hard time getting through the gauntlet nowadays. There seem to be so many built-in obstacles that it's very hard for the United States to get arms to where we need them; where our soldiers will not be at a disadvantage to the enemy.

That's why I'd like to see us push this thing through as fast as possible. And I do know there are some problems. But from the studies that I have done, it appears to me there isn't anything that can't be handled technologically with the development of that tank. I don't know about the second diesel fallback. That may be good insurance, as you say—it may not be necessary.

Did you want to comment on that, or were you just moving the mike there?

Mr. HORAN. I'd just like to reiterate something Mr. Sheley said earlier and perhaps clarify the General Accounting Office position on this. We haven't, in our recent report, taken the position that the tank should not be put into full production or fielded in Europe.

We recognize, very clearly, that there are many factors that would have to go into that decision. Some of those are military judgments and certain congressional policies, certainly.

The report was trying to point out, for the use of the Congress, the severity of some of the problems that had not been dealt with and probably would arise if something isn't done between now and the time the tank is fielded to take care of it.

Our point is, make the decision, but make it on the basis of knowledge of the types of problems we're facing.

If the final decision is to go ahead, that's not our decision. We're trying to provide information to make a more rational decision.

Senator SYMMS. I guess what you're really saying, the modified M–60, you could build 1.7 of those for each M–1 that you build, and then you have—logistically, the Army has to decide whether they'd really rather have one of these that takes less fuel for the one than the 1.7 and what would be able to be the most effective in a counterforce, in a strike force use.

Mr. HORAN. Yes, sir.

Senator SYMMS. Thank you very much, Senator Proxmire.

Senator PROXMIRE. Thank you, Senator Symms.

We did put the M–60A2 into Europe and then found we had to withdraw it because it had maintenance problems and other problems; isn't that correct?

Mr. HORAN. That's right.

Senator PROXMIRE. So the kind of investigation you're making and the kind of inquiry I hope we're making may help us avoid that kind of a mistake. It would seem to me that that can be very constructive. I hope we don't come to a point where we feel we can't challenge these weapon systems vigorously and strongly. I think we have a much better opportunity to develop a strong defense if we do the kind of job we're supposed to do up here and don't hesitate to challenge whatever system comes before us.

Now let me find out clearly what you two gentlemen are providing us, because they differ.

Mr. Horan, you've been talking about a report here in which the data goes from, you said, December 1980.

Mr. HORAN. That's right.

Senator PROXMIRE. This chart, on the other hand, is May 1981; is at right? These are the latest test results here on this chart?

Mr. SHELEY. The raw test results. I want to emphasize that, Senator. That is still raw data at this point.

Senator PROXMIRE. Raw test results? That's correct? All right.

Now as far as you know, is the Army concerned about what could be a coming crisis in support services, and does it have a comprehensive plan for meeting it?

Mr. HORAN. There's a very obvious recognition of the consequences of not solving some of these maintenance problems and the adequacy of the plan to solve it. We're just not in a position to comment on that. That would be part of what would come from the testing.

Senator PROXMIRE. Let me follow that up by asking you, in your view, if the M–1 tanks were sent to Europe according to present plans, will there be adequate support services for them or will they worsen the support problem for the M–60 and other weapons in Europe?

Mr. HORAN. I don't think we can really tell what might happen between now and the time they would actually field the tanks. There are some of those problems that probably could be overcome if some early action is taken right away. Some of the others—for instance, if you can't get those field trucks over there in time—you would have a more severe problem than you now have. It's difficult to say with any degree of certainty just how that will turn out.

Senator PROXMIRE. In 1976, the GAO reported to the Joint Economic Committee on problems with the U.S. military equipment in Europe. The report found serious problems with equipment readiness criteria, equipment condition, maintenance and repair programs, and readiness reporting.

Don't we have the same problems today, especially with the M–60 tank?

Mr. HORAN. We have some of the same problems; they recur. It's skill problems, maintenance problems, test equipment problems, depot problems, spare parts problems. All of those things in varying degrees are still occurring.

Senator PROXMIRE. I'm going to have to leave to vote. I'll come right back. I shall be back in less than 10 minutes.

I'm going to suggest that the counsel for the full committee, Mr. Kaufman, who has done a lot of work on this, ask questions while I'm gone so we can use every bit of time we can, and I'll be back very shortly.

COST OF M–1

Mr. KAUFMAN. I'd like to get some information about the cost into the record.

Looking at GAO's 1975 report on the status of selected major weapons systems, reporting SAR costs as of June 1974, it showed that the estimate for the M–1, called XM–1 at that time, was $3 billion for 3,360 tanks—as I say, as of 1974. The estimate to complete the program is currently $19 billion for 7,058 tanks.

As I interpret that data, that means the unit cost has increased on a program unit cost basis from $900,000 each in 1974 to $2.5 million each today. Are those figures correct ones?

Mr. SHELEY. They're approximately correct, sir. The quantity for the tank is 7,071. There's 13 development model tanks that are included in that, but the numbers as of March 1981, which is probably a little more current than your numbers for the total program, is $18,585 billion. That probably resulted from using the slightly different Reagan administration inflation factors as opposed to the ones that were used in the December 31 SAR.

Mr. KAUFMAN. Is it correct that the 1974 unit cost figure of $900,000 per tank is comparable as a program unit cost estimate to the $2.5 million cost estimate today?

Mr. SHELEY. I think it's a comparable number, yes.

Mr. KAUFMAN. Has the GAO analyzed the reasons for the cost overruns since 1974? And if you have, can you give us an explanation of those cost increases?

Mr. SHELEY. A substantial part of it—and I don't have the exact percentages here—but a substantial part of it was related to inflation. I can supply this for you for the record, but I don't have it with me today. But a good part of that total increase is attributable to increases in inflation.

[The following information was subsequently supplied for the record:]

According to the Army's Selected Acquisition Reports, approximately 60 percent of the cost increases is attributable to inflation. However, it should be noted that much of this inflationary growth is attendant to major changes made during the program, including increasing the total buy to 7,058 tanks, opening a second production facility, and adding the 120 millimeter gun, as well as production startup problems.

Mr. KAUFMAN. If one looked at the wholesale price index or at the GNP deflator or the index for increases in prices for Government purchases, it's hard to come anywhere near the rate of price increase due to inflation using those indexes that has occurred since 1974 in the case of the M–1 tank.

Mr. SHELEY. That's true, if you just look at that data. But the actual inflation rates in the aerospace industry, which would include items like a tank, has been higher than normal. I've seen estimates as high as 20 percent for the aerospace industry. Comparatively, the across-the-board inflation rate was running at about 10 to 11 percent.

Mr. KAUFMAN. Are those published series of price indexes for the defense industries, and can you cite where those series of data come from?

Mr. SHELEY. No; one of the estimates came from the Defense Science Board that made some study, and they had some qualifications on it. I have to agree that they're not precise numbers by any means. They're not generally supportable in terms of nationwide indexes, but when you look at the costs in that area, they seem to be at a higher rate. How much higher is debatable, but there is no question in my mind that it's higher. But I can't prove it to you; I don't have any hard data that I can point to and say, "This supports that position."

Mr. KAUFMAN. It is correct, is it not, that the Government does not publish any special inflation indexes for the defense industries?

Mr. SHELEY. The nearest it would come to that would be the Bureau of Labor Statistics index for heavy durable goods manufacturers. That has been slightly above, as I recall, the average. I don't have the exact numbers here, but my recollection is that it has been slightly above. That is the nearest comparison that you can make as far as published data is concerned.

Mr. KAUFMAN. When one talks about high rates of price increases in particular industries or with particular firms, those causes could be other than from general economic inflation; could they not?

Mr. SHELEY. Absolutely. The shrinking industrial base and the bottlenecks that are developing in the supply system, particularly at the subcontractor and vendor level in the aerospace business in the defense arena, are driving costs up because the numbers of people concerned that can make parts is gradually shrinking over the years. Forgings and castings, for example, are a good example. There's only a handful of companies that can make the intricate forgings and castings

that go into aerospace products today—military weapons systems. The same is true for electronics; just little bits and pieces that go into electronic gear. There is a tremendous commercial market, and the people that manufacture these are leaving the Defense Department because they don't want the hassle of having to deal with the Government redtape in procurement. They can sell all they can produce on the commercial market. If you want to buy electronic chips now, you've got to pay a premium to get them.

Mr. KAUFMAN. In the case of the M–1 tank, it is true that Chrysler is the only company producing this tank, so it in effect has a monopoly on Army tanks.

Mr. SHELEY. At this point in time, it is the only one that's producing it. As I recall, Chrysler produced the M–60 tank. So it is the only one that has built a tank for the last 15 years. But it also is dependent upon a large chain of subcontractors and suppliers.

Mr. KAUFMAN. Has GAO had an opportunity to analyze the cost increases in the tank program to determine whether or not these price increases are simply administered by the monopoly producer of the tank, in this case, or whether they are in fact due to general national economic inflation?

Mr. SHELEY. We have not made such an analysis. It would be very difficult to come to a firm conclusion on that.

Mr. BARAS. There are two basic reasons for the increase. Now we haven't analyzed the record of the negotiations, or we haven't reviewed them, but the two basic reasons are this:

First, there's been an increase in the rates of inflation that the Army is now projecting as compared to what they were projecting earlier in the program.

Second, these rates are now being applied to a higher base. This higher base represents the experience from the receipt of the proposals from Chrysler for the first 3 years of production.

Mr. KAUFMAN. Is the contract with Chrysler a cost-type contract or a fixed-price-type contract?

Mr. BECKEMAN. Fixed-price incentive.

Mr. KAUFMAN. In that case, how can they change the cost base of the contract in order to change it from an earlier one to a later one?

Mr. SHELEY. Normally almost any fixed-price contract that's going to extend over a prolonged period of time, like this one would, provides for escalation factors in materials and labor, which are then measured by some industry-accepted indexes.

Mr. KAUFMAN. In other words, this is an escalating fixed-price-type contract?

Mr. SHELEY. That is correct.

Mr. KAUFMAN. Do the costs that have been cited for the tank include the ammunition for the main gun and the cost of replacing the 105-millimeter gun with a 120-millimeter gun?

Mr. SHELEY. It does not include the cost of the ammunition. That is funded as a line item in the ammunition procurement account. It does include the modifications to the tank to adapt the 120 gun. It also includes the 120 gun itself. It's roughly $80,000 per tank. That's included in the current estimate to modify the tank to accept the 120 millimeter.

Mr. KAUFMAN. How many tanks will be produced before the new 120-millimeter gun is put on?

Mr. BARAS. That would depend on whether or not the Army receives the authorization to go ahead and increase its production above the current limit of 360 a year. But if they do get that authorization—and the Army is planning to incorporate this 120 millimeter about the fourth year of production—there should be close to 2,000 tanks produced with the 105 before the transition to the 120.

Mr. KAUFMAN. Do you have estimates for the cost of the ammunition that are not included in the tank cost estimates?

Mr. SHELEY. We do not have that estimate. It would vary upon a lot of factors, depending upon what assumptions you make as to fire rates, et cetera. The unit cost is available, and we can get it and supply it for the record, but I don't have it with me.

Mr. KAUFMAN. If you could supply that for the record.

Mr. SHELEY. We will so do.

[The information referred to follows:]

The unit costs for the 105-mm ammo, as provided in documents supporting the fiscal year 1982 budget

	Unit cost
105-mm cartridge:	
HEAT-T	$497
TP-T	180
DS-TP	233
APFSDS-T	648

Current Army planning estimates for the 120-mm ammo unit cost

	Unit cost
120-mm cartridge:	
HEAT	$1,065
Kinetic energy (XMA-29)	1,147
Training:	
XM-831	607
XM-832	911
XM-827 (interim buy)	2,500

These estimates are preliminary and subject to change. The Army is currently reviewing the program.

Mr. KAUFMAN. Do the costs cited for the tank include the approximately $800 million planned for block improvements in the tank?

Mr. SHELEY. No; that is not included in the current estimate.

Mr. KAUFMAN. Can you discuss what the block improvement program is designed to do?

Mr. BECKEMAN. No. I do not have them with me today. I can describe a few of them.

For example, they're going to improve the commander's weapons stations as one of the planned improvements, but I don't have all the listings with me today.

Mr. BARAS. We have one witness who can give you the details.

Ms. BRANNIN. There are basically five product improvement programs that the Army is currently working on. They haven't all been approved yet by OSD, I understand. That's two nuclear, biological, chemical improvement programs, an armor improvement program, auxiliary power unit program, and a weight reduction program.

I believe those are the five that the $800 million we're talking about included.

Mr. KAUFMAN. I didn't understand whether the cost of this product improvement—block improvement program was included in the cost figures cited for the program costs of the tank.

Mr. SHELEY. It is not in the procurement costs at the present time.

Mr. KAUFMAN. And that is, as I understand it, approximately an $800 million cost item that is not included in the current estimated cost of the tank?

Mr. SHELEY. Your number is correct on that. And as those improvement programs are approved, then they will be incorporated in the estimate in the future.

Senator PROXMIRE. How would that be translated into the cost per unit of the tank, per copy?

Mr. SHELEY. It would depend on which unit they became effective on, sir. They would probably not all be effective on the same unit, so it would depend on that, and you would have to divide by the number of units remaining at that point in time.

Senator PROXMIRE. Say we'd include it in half the tanks. This would be an increase, then, of about how much per tank?

Mr. SHELEY. On the order of $800 million divided by roughly 3,000 tanks—3,500 tanks—would be something like about $200,000 per tank.

Senator PROXMIRE, During my visit to the floor to vote, I went over with Senator Rudman, who is one of the people who have driven this tank just in the last few days—he had gone to Fort Knox—at any rate, wherever the tanks were. He was really sold on it. He just thought it was dandy. He said it's like driving a Porsche instead of a bicycle.

He also said that there were some dramatic changes that hadn't been reflected in any of this data in about 10 of these tanks. They had reworked the transmission, and solved the transmission problem.

Is that your understanding?

Mr. SHELEY. That's my understanding.

Senator PROXMIRE. Do you have any idea how much that kind of change would cost?

Mr. SHELEY. I don't think it was a very expensive change at all—just modifying the cooling system, also putting in an override safety thing so that it could not be pushed into reverse gear while it was moving.

Senator PROXMIRE. You said that was one of the problems. What they had been doing is going full tilt ahead, and all of a sudden, in order to shift their position, they would ram it into reverse. If you did that with any car I have ever had anything to do with, there goes your transmission forever.

Mr. SHELEY. But they now have a fix on it. It's an override that will not permit it to go into reverse if it's traveling over around 3 miles per hour, plus a slightly different clutch. The Army was able to demonstrate and repeat the failure at Fort Hood last month on three tanks. Then they installed the new clutch in them. They went through the same maneuvers, and they were unable to damage the clutch at that point in time.

Senator PROXMIRE. Let me, just for one moment, get away to another point.

Senator Symms spoke about how we don't have the neutron bomb in Germany. Isn't the reason we don't have the neutron bomb in Germany the fact that the Germans don't want it, they wouldn't touch it with a 10-foot pole?

It has nothing to do with the press or resistance in this country—although there's a lot of resistance to it—but the Germans have made it very clear that they simply don't want it in their country, for obvious reasons?

Mr. SHELEY. That is what I have read in the newspapers.

Senator PROXMIRE. Is it possible the costs would increase further—as I get back to the tank—and reach or exceed $3 million for each M–1 tank?

Mr. SHELEY. I think that's possible, depending on how long the tank is in production, and how severe the inflation rates may be in the future. It's very difficult to predict at this time.

SUPPORT COSTS OF M–1

Senator PROXMIRE. What's your estimate of the total support cost of the M–1 during the expected life of the tank?

Mr. HORAN. We haven't been able to develop an estimate. The Department of Defense has always had trouble coming up with precise estimates. The people we talk to talk in ranges.

Senator PROXMIRE. I'd like to know the range. What's the range of possible life-cycle costs for the M–1?

Mr. HORAN. I think the one you hear most often is 2 to 1. The support costs would be twice as high as the initial acquisition costs.

Senator PROXMIRE. So the initial acquisition cost is $3 million, and the support cost would be $6 million?

Mr. HORAN. That's right.

Senator PROXMIRE. Wow.

Does the Army have an estimate of M–1 support costs? Is that about 2 to 1, too?

Mr. HORAN. It may be. Well—it's one of those speculative things. I guess that's about as close as we can come to it: 2 to 1.

Mr. SHELEY. They have an estimate, Senator. We've looked at it, and we're not very comfortable with some of the assumptions that were made. Their estimate is $25 billion, but that was made 1 year or so ago, and I would be a little uncomfortable saying that that is representative of the life-cycle costs.

Senator PROXMIRE. I take it that these are all kind of rough general estimates; not pinned down?

Why doesn't the Army, Navy or Air Force make support costs on a regular, systematic basis for their major weapons systems?

Mr. SHELEY. They're beginning to move into that. One of the biggest problems is trapping current data that will give you a basis for projecting into the future, using current systems. You always have to make some judgmental decisions, because what you're going to field 5 years from now is not what you've got in the field today. So you have to do some extrapolation to go from that kind of data to what you can expect in the future.

Senator PROXMIRE. There should, at least be estimates. The estimates may be wrong. We can criticize them; we can say they're too low or too high.

But there are no hard estimates for this big weapons system?

Mr. SHELEY. I haven't seen anything that's reasonably current.

Senator PROXMIRE. When can we expect to get it?

Mr. SHELEY. I think you'll just have to ask the Army that, Senator.

Senator PROXMIRE. The services do estimate procurement costs. Congress gets quarterly reports, allowing us to see the status of major acquisitions.

Doesn't the M-1 case illustrate how important it is, also, to keep track of support costs?

Mr. SHELEY. Very much so.

Senator PROXMIRE. You say it's twice as high as acquisition?

Mr. SHELEY. That's the minimum. On some systems that are more complex, the ratio is even higher than 2 to 1.

Senator PROXMIRE. Do you favor a reporting procedure requiring the Pentagon to provide to Congress, on a periodic basis, support cost estimates for each of the major acquisitions?

Mr. SHELEY. It would be very difficult to be against that. My only concern is that you would have to be sure you knew what you were getting, and use it accordingly, and not use it as a yardstick.

Senator PROXMIRE. Once we got it, we could call to their attention, after a time, that they were understating it—if they were doing so—and keep it honest that way.

Mr. SHELEY. But if you use it as a yardstick to measure them in the future, and hit them over the head, and say, "you're exceeding this operation and support cost," without taking into consideration that you started with soft costs to begin with, then you'd have a reluctance on the part of OSD to submit that data to you.

But I cannot be against the requirement that they do that.

Senator PROXMIRE. Isn't it correct that at present, Congress does not receive from the Pentagon a breakdown of support costs by major weapons?

And if the support costs double or triple, as you say they might, during the procurement, because of poor planning or mismanagement, we'd be ignorant of the fact.

Mr. SHELEY. I think that's correct. What you get now is just line items for operation and maintenance, which is not broken down by weapons system.

Senator PROXMIRE. Why do you think the Army failed to emphasize logistics support during the early stages of the M-1?

Mr. SHELEY. Part of it had to do with the design to cost. They wanted to keep the acquisition costs down. In so doing, they made tradeoffs that are going to affect them in the life-cycle costs.

Senator PROXMIRE. Well, by doing that, it also meant that the Congress, which makes the fundamental decision, wouldn't have the information they ought to have.

Mr. SHELEY. That's right. In effect, when you make those kinds of decisions, you are mortgaging the future.

RESULTS OF FAILURE TO EMPHASIZE LOGISTICS SUPPORT IN M–1 TESTING

Senator PROXMIRE. Do you believe the Army's failure to emphasize logistics support will make it more difficult for the Army to support the M–1, or will increase support costs for it?

Mr. HORAN. Yes. We think that's inevitable. It's pretty much recognized that front-end logistics considerations, up to the point that the prototype design has been accepted, presents the greatest opportunity to make reductions in support costs. If you haven't done it by the time you've accepted the prototype, you're going to be in a catchup position of making modifications from that point on. And that's just a more costly way to do business.

Senator PROXMIRE. In your opinion, does this case illustrate the fallacy of rushing into production without adequate attention to logistics support?

Mr. HORAN. We think it does. It's a very good example of what can happen if you don't give logistics support the attention it deserves.

Senator PROXMIRE. Do we already have a serious logistics support problem in our European forces?

And has that been caused, in part, by inadequate attention to logistics support?

Mr. HORAN. That's true. Partially due to the inadequate logistics support.

Senator PROXMIRE. Now, the information over here, on this chart, comes from the GAO report on logistics planning.

Is it correct that the Army has been behind schedules for 11 out of 12 logistics events in the Army's own plan?

Mr. HORAN. That's true.

Senator PROXMIRE. Take the first item, "conduct validation of technical manuals."

Are you saying validation was supposed to be completed in November 1980, and may not be completed until November 1982?

Mr. HORAN. That's right.

Senator PROXMIRE. Does this mean that hundreds of tanks will be produced and possibly sent to Europe before validated technical manuals are available to the troops who will operate and repair them?

Mr. FERBER. Yes. This is true. This is currently identified as a major problem by the Army's own logistics evaluators, and the M–1 project manager's office will have to request a waiver, in order to field a tank without verified and validated technical manuals.

Senator PROXMIRE. What's the significance of not having the manuals?

Mr. FERBER. Your technical manuals are what both your crew and your mechanics have to refer to, in order to determine how to either operate or repair a tank. Without validated and verified manuals, there is no assurance that they can troubleshoot maintenance problems nor do the maintenance tasks that are necessary.

In the worst case, you could run into safety problems, because the technical manuals have not been verified against the needs of maintaining the tank.

Senator PROXMIRE. I must say that it's hard for me to understand how they can't have those manuals done on time and sent there. I can understand the hardware problem, the technology problem.

Mr. FERBER. One of the problems, as we discussed in our report, on several of these logistics areas is that because of the considerations on hardware development, there was no prototype dedicated to determining your logistics support. That's one of the major causes of all the reasons on that chart, as to why they're behind schedule.

Senator PROXMIRE. Now, how significant is it that the Army has not completed a logistics action scheduled for completion on the chart?

Will there be any long-term effects and cost consequences of these delays and failures?

Mr. FERBER. The consequences, again, as we point out, are that you have a decision coming up in September on whether to field a tank, and yet your logistics infrastructure is not yet complete. If the tank is fielded, then you're going to have to take extraordinary measures, which could drive up your logistics costs, in order to support a system where the logistics infrastructure is not complete.

Senator PROXMIRE. According to the chart, the depot in Mainz, Germany, won't be complete until 1986, 5 years late.

Does that mean, for example, that engine overhauls will have to be done in the United States, rather than Mainz, until at least 1986?

Mr. FERBER. It's a phasing in process. Initially, the contractor, Chrysler, will be doing the depot-level support. To the extent that he has the responsibility, he will likely ship the tanks back to Europe for that portion of the maintenance. When the Army initially takes over the organic in-house support, FOL support, they will probably ship, initially, back to Anniston, Ala.

Senator PROXMIRE. That means that anytime a tank breaks down in Europe, they'll have to ship that tank back to the United States?

Mr. FERBER. Not necessarily.

Senator PROXMIRE. Or breaks down because of an engine failure?

Mr. FERBER. Yes. They would just pull the engine and replace it, which they can do there.

Mr. HORAN. They would send the engine back for overhaul. The tank would stay there, and they would replace the engine.

Senator PROXMIRE. I see.

Mr. FERBER. They're going to phase in component repairs, so it's going to depend on the severity of the problem and the time, against their schedule.

Senator PROXMIRE. Do they have the capability for replacing engines in Europe?

These are turbine engines, and I understand they send all the turbine engines back to the United States and the Air Force for repair.

Mr. FERBER. They will have depot capability for the engines.

Senator PROXMIRE. They will not have?

Mr. FERBER. They will; they do not now.

Senator PROXMIRE. When will they have it?

Mr. FERBER. The organic capability for Mainz is 1986. They're supposed to have the inhouse capability, I believe, in 1983 for Anniston.

Senator PROXMIRE. What do they do between now and then?

Mr. FERBER. Interim contractor support. Their own assessment says that they're going to require extensive contractor support for at least 1 year, and possibly 2 years.

Senator PROXMIRE. What will that cost?

Mr. FERBER. I'm sorry. I don't have those figures.

Senator PROXMIRE. Could you get that for us for the record?

Mr. FERBER. Yes.

[The following was subsequently supplied for the record:]

Because fielding and maintenance plans have not been developed, accurate estimates of these costs could not be developed.

Senator PROXMIRE. Does the Army plan to overhaul and repair M–1 engines in Germany or the United States after 1986?

Mr. FERBER. Both. They have depots in the United States and in Europe.

Senator PROXMIRE. What's the significance of the fact that the Army may not have the capability for overhauling engines in Europe?

Mr. FERBER. Initially, without the depot-level capability, they are going to have to increase their pipeline for both spare engines and other spare components; by not having the capability to do the work there, then they're going to have to increase their supply support.

Senator PROXMIRE. What are the cost consequences of that failure?

Mr. FERBER. We will try to provide that for the record.

[The following was subsequently supplied for the record:]

Because fielding and maintenance plans have not been developed, accurate estimates of this cost could not be developed.

Mr. FERBER. This could become a more serious problem if they run into further production problems.

FUEL CONSUMPTION OF M–1 AND ITS COSTS

Senator PROXMIRE. Let's talk about fuel and support trucks. How much fuel does the M–1 consume? How does it compare with the M–60?

Mr. HORAN. We understand the M–1 uses about 4 gallons per mile.

Senator PROXMIRE. Four gallons per mile? Not 4 miles per gallon?

Mr. HORAN. No, sir. The M–60 uses approximately 1.2 gallons per mile. These numbers will vary, depending on the amount of operation, how much idle time, and all that.

Senator PROXMIRE. Why is there that spectacular difference? Why is it so much less efficient the M–60, one-fourth as efficient, or even one-fifth?

Mr. HORAN. There is a different engine. The turbine engine is being used, rather than a diesel engine which is used in the M–60. The tank is heavier. It also operates at a higher speed, and it is more mobile.

Senator PROXMIRE. Doesn't that have a profound effect on its range?

Mr. SHELEY. Very definitely.

Senator PROXMIRE. How big a fuel tank do they carry?

Mr. SHELEY. We have that information.

Let me add one thing to it. There's another factor to it. There's a difference in horsepower between the engines. The M–60 has a 750–horsepower diesel engine, as opposed to the 1,500–horsepower turbine engine that's in the M–1 tank. That accounts for some of the fuel consumption. But the other factors, as Mr. Horan pointed out, account for more. A turbine engine is just not as efficient as a diesel engine.

Senator PROXMIRE. Does the M–1 carry fewer rounds of ammunition than the M–60?

Mr. SHELEY. Yes, sir. The M–60, I believe, carries 63; and the M–1 will carry 55.

Senator PROXMIRE. So the difference isn't very great, sir, 63 compared to 55?

Mr. SHELEY. No, sir. It's about 10 percent. The 120 millimeter would drop it down to approximately 48 rounds.

Senator PROXMIRE. If significant numbers of M–1 tanks are sent to Europe in 1982 or thereabouts, will there be adequate fuel and trucks to support them?

Mr. HORAN. There will be adequate fuel. There will be a problem with the ability to transport the fuel and the ammunition to the tanks, for any lengthy period of time, because of the shortage of trucks.

Senator PROXMIRE. What's the range comparison, in view of the fact that the M–1 uses up so much more fuel?

What is its range, compared with the M–60?

Mr. SHELEY. The M–1 range is approximately 270 miles; the M–60 is 280.

Senator PROXMIRE. But then the M–1 has an enormous fuel tank?

Mr. SHELEY. Yes; it has a large fuel tank.

Senator PROXMIRE. Is it fair to say that more fuel and trucks will be required to support the M–1 than the M–60?

Mr. HORAN. Yes.

Senator PROXMIRE. How many more trucks will the Army have to buy, and how much will they cost?

Mr. HORAN. We don't have complete figures. We didn't develop figures in the study we made. But each battalion will need 26 more vehicles—let's see—and some support equipment to go with the vehicles. That would increase the cost per battalion by about $633,000. That's just for the fuel vehicles.

We don't have figures on the ammunition or on other vehicle requirements.

Senator PROXMIRE. Is there a major difference in operational cost, lifetime operational costs, because of the difference in fuel consumption?

Is that one of the big reasons or not?

Mr. HORAN. It is a very significant reason, a very substantial cause of the increased operating costs.

Senator PROXMIRE. How much of a difference does it account for?

Mr. HORAN. We don't have any figures on that. Perhaps we can get something for the record.

[The following information was subsequently supplied for the record:]

Estimated fuel costs required to operate one M60 tank over a 20-year life (assuming mileage of 2.4 gallons per mile, yearly mileage of 1000 miles and fuel costs of $1.42 per gallon) are $68,160. Mileage for the M1 is currently estimated to be between 3.9 and 4.4 gallons per mile. Thus, fuel costs for operating one M1 tank over a 20-year period assuming similar annual mileage and fuel costs) would be expected to range between $110,760 and $124,960. The additional fuel operating costs per tank will range from $42,000 to $56,800. Fuel costs for the entire tank fleet can be estimated only after determining how many tanks will be operational over a given period.

Additionally because the M1 consumes about fifty percent more fuel than an M60, the Army is taking action to add to each M1 tank battalion a capacity to haul an additional 10,800 gallons of fuel and to each division support command capacity to haul an additional 5000 gallons of fuel for each M1 battalion supported. The major equipment increases and costs per battalion are tabulated below. The Army states this adjustment will provide sufficient fuel in the tank battalion for 48 hours of operation.

[Dollar amounts in thousands]

	Quantity	Unit cost	Total cost
Trucks, cargo, 5-ton	6	$70.3	$421.8
Truck, tractor, semi 5-ton	1	76.4	76.4
Trailer, petroleum, 500-gal	1	48.8	48.8
Trailer, cargo, 1-ton and ½-ton	6	4.2	25.2
Tank and pump unit	6	8.5	51.0
600 gal, p.o.d	6	1.6	8.6
Total (per battalion)	26		632.8

LOGISTICS—PROBLEMS SUPPLYING FUEL TO M–1

Senator PROXMIRE. Is it true that there are many problems with a large truck called the Goer, used in Europe to support the M–60 tank?

That it's difficult to operate and often in maintenance because of mechanical problems?

Mr. HORAN. We have heard of problems with the Goer, but I don't have any specifics on it.

Mr. FERBER. The only thing I've heard on the Goer is that it was an off-the-shelf product, a Dodge truck designed initially, being a commercial vehicle, for primary and secondary roads. Now that they're using it in an operational environment, it has developed problems.

Senator PROXMIRE. Have you asked the Army—or do you know how the Army plans to manage the problem of the Goer trucks and the problem of the shortages of trucks, and how much that will cost?

Mr. FERBER. Well, we haven't asked that question specifically. We did have a briefing about a month ago, on a project—I think it's the logistics assessment—where they are quantifying, by fiscal year, the shortfalls in such things as POL vehicles, and the dollar amounts they would need to get well.

COSTS OF SPARE AND REPAIR PARTS

Senator PROXMIRE. According to your report, the Army has spent over $400 million for M–1 spare and repair parts.

Isn't it true that experience with other procurements shows that spares bought early often become obsolete and, for that reason, the service is supposed to minimize early spares and repair parts procurement?

Mr. HORAN. That kind of problem has been identified earlier. It's one of those dilemmas that faces every major acquisition, I think, as to whether to go ahead and try to get an economic order for spares, yet not buy so many that if there's a design change——

Senator PROXMIRE. Well, what's your judgment on this? Does the $400 million purchase of spares and repair parts, at this stage of procurement, seem excessive to you, or was it reasonable?

Mr. FERBER. I guess we don't have a judgment on the right dollar amount. But we did point out in our report that, because of what they're experiencing in production delays and potential consequences of delaying fielding, they should reevaluate the requirements considering tank configuration changes, the updated test data, and various factors that should go into such a recalculation of needs.

Senator PROXMIRE. Is it correct that a large portion of $400 million went to Chrysler in sole source contracts? If so, how much was spent on sole source contracts?

Mr. FERBER. We don't have that data. We'll have to provide it for the record.

[The information referred to follows:]

According to the Army about $316 million (79 percent) of the Army's current $400 million investment in M1 spare and repair parts have been purchased sole source from Chrysler, the M1 prime contractor.

Senator PROXMIRE. Is there any indication yet that a significant portion of the spares and repair parts are already obsolete?

Mr. FERBER. There have been some parts that have been identified and the Army is on top of that and has taken various actions, either with the parts that have been received or those in the pipeline, to correct those problems.

TEST EQUIPMENT

Senator PROXMIRE. Would you explain what the test equipment is and how it is supposed to be used in typical breakdown in the field, and what is wrong with this aspect of the tank program?

Ms. DENMAN. I am Julia Denman, evaluator with the General Accounting Office. The primary item of field test equipment on the M–1 is called the STE M–1. I have a picture here that I can provide you, sir. The test set weighs about 370 pounds, it's about 20 cubic feet, it's placed in about seven black boxes. The organizational maintenance concept is that these particular items of support and test equipment would go from the motor pool forward to the tank, wherever it has broken down. The Army doesn't currently have a vehicle that would be able to handle this volume of test equipment, so they'll probably have to buy more trucks.

At the organizational level we're talking about, a company of tanks, so depending on the current organizational structure, we're talking approximately 17 tanks. What they would do is take this particular piece of support and test equipment forward. They would try to get it through the hatch of the tank into the tank and attach it to the partic-

ular component on the tank that was deficient and the support and test equipment would hopefully identify which particular black box was in fault. Then, if they properly identified it, they would try to pull that particular component and replace it with another major component.

Senator PROXMIRE. And the problems—what's wrong with this aspect of the tank program? You said there's not enough trucks?

Ms. DENMAN. That is one problem. But the major problem is the level of maturity in the support and test equipment is not such that it can correctly identify the faulty component at this point in time. It results in tanks being down for long periods of time because they can't identify what's wrong with the tank.

Senator PROXMIRE. What progress are they making in that?

Ms. DENMAN. They're making progress on the software of the test sets, but recent testing indicated there are still some major problems.

Mr. SHELEY. That was pointed out during the tests both at Fort Knox and at Fort Hood. I believe the people at Fort Knox pointed out something like about a 65 percent reliability of the test equipment. At Fort Hood it was much lower, in the vicinity of 20 to 30 percent reliability of the test equipment.

Senator PROXMIRE. Put that into perspective. What does that mean, when it's only one-third reliable?

Mr. SHELEY. That an awful lot of time is spent trying to find out where the problem really is. You fix things that don't need fixing, in some cases.

Senator PROXMIRE. How does that compare with other test equipment?

Mr. SHELEY. It depends on the stage of it. This is the first generation.

Senator PROXMIRE. What I am trying to get at is whether or not it is significant that you have this poor a performance at this stage? Maybe it's standard.

Mr. SHELEY. It's probably close to standard. I'm aware of the automated test equipment, for example, on the F–15 airplane. They've had similar problems. I don't know that the numbers correspond exactly, but I know there have been severe problems with the reliability of that test equipment. In automated test equipment, usually the first generation of it is fairly unreliable and it takes some shaking out and building in some additional capabilities that were not anticipated at the beginning. But I wouldn't think this is out of line.

Senator PROXMIRE. Is this another element that will increase the cost of the program?

Ms. DENMAN. Yes, sir. The cost of the particular piece of equipment that I showed you is about $185,000. This is just organizational level equipment and the organizational level only supports about 17 tanks. So when you talk about the entire inventory of tanks, we're talking about a lot of money. The Army has never used an extensive amount of support and test equipment on an armored vehicle such as the M–1 before. The M–60A–3 uses it, but not anything as sophisticated as the equipment that we have here. So the problem will be one of, getting the software to a level of maturity that will allow identification of all the faults which it currently can't identify.

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Another significant problem is that setting up the test equipment requires from 30 minutes to 2 hours and this must be done before you even start your checks. Then, if you find a faulty component or one that registers as being faulty, then you may remove that component and put another one in. And you have to start your check all over again. You can't start up right in the middle of a procedure and continue forward. You may get to the same point and it will stop again. So it comes to a point where, during testing, they had tanks that were down for 30 to 45 days and they couldn't identify what was wrong with it.

Senator PROXMIRE. Isn't it true that the average enlisted man is already having difficulties in repairing and maintaining complex weapons because of lack of skills? Will the M–1 test set make it easier for our troops to keep the M–1 going, or is the test going to be so complex that it might make it even more difficult?

Mr. HORAN. Yes, sir. Problems of that type are being experienced today. As you introduce a new piece of test equipment, particularly a complex piece, it requires new training. You run into the same kinds of problems.

The manuals were another thing that we mentioned earlier. The manuals have to be very explicit in terms of the instructions that the mechanics are using to troubleshoot. The manuals, as a result, are becoming enormous. The number of pages, I believe, are something like 19,000 pages of manual instructions on how to do certain things. So it's a very difficult thing.

Senator PROXMIRE. How does the pay compare for people who are supposed to help maintain a tank like this with what a comparable mechanic could earn in the private sector. Do you have any idea at all? Is it comparable or is it much lower?

Mr. HORAN. I don't have any real figures on that, but I was in Europe in May and we were told every place we went, practically, that it was a problem in retaining skilled mechanics; that they could get better jobs, higher paying jobs, out in the private sector.

Senator PROXMIRE. Can you solve that problem by better pay, by bonuses, by trying to target the people we so urgently and desperately need to provide substantial increases in pay for them?

Mr. HORAN. This is one way. I believe the General Accounting Office has advocated targeting incentives to the skill categories that you have the greatest need for, rather than across-the-board increases.

PRODUCTION DELAYS

Senator PROXMIRE. In your prepared statement you cite the production schedule delays at Chrysler and Avco in terms of the number of tanks and engines delivered. Can you convert those figures into numbers and months behind schedule, and can you discuss the reasons for the delay?

Mr. SHELEY. Part of the reason for the delay at Chrysler was they were opening up a new plant at Lima and they brought in a lot of new workers, a new work force, there.

Senator PROXMIRE. Where is that new plant located?

Mr. SHELEY. Lima, Ohio. That was part of it. They had unanticipated startup problems.

Senator PROXMIRE. I was hoping you'd say Wisconsin, but I knew it wasn't there. [Laughter.]

Mr. SHELEY. That's part of the problem. And part of the problem at Avco was transitioning from the initial development models to the production models and they had some problems there. On the transmission problems, they had the initial transition from the development model again to a production model. However, the transmission now and its delivery are pretty well current. They are not too far off on the transmission at this point in time.

Let's take the current schedule. This is not the original tank delivery schedule, but this is the current schedule. They should have delivered 220 and they have delivered 125 through June of this year.

Senator PROXMIRE. Can you tell me the number of months they're behind schedule?

Mr. SHELEY. Probably about 8 months, roughly.

Senator PROXMIRE. Was the schedule unrealistic?

Mr. SHELEY. That represents not a substantial decrease but a decrease nevertheless from the original schedule, and it is ambitious. It is success-oriented. I think I would have to agree that it is success-oriented.

Senator PROXMIRE. Success-oriented, but they weren't successful.

Mr. SHELEY. No. And on the engines, they should have delivered 407. They've delivered 180 at this point in time.

Senator PROXMIRE. 180 instead of 407.

Mr. SHELEY. Yes. They are increasing their production, they are getting better, but they are still a long way away from schedule.

Senator PROXMIRE. Are you saying the delays will get shorter in the next year?

Mr. SHELEY. I would say, with guarded optimism, they will get shorter. Last month, for example, Avco produced 29 engines. That is the first time they've gotten anywhere near that number. Chrysler only produced 18 tanks last month.

COMPONENT DEFECTS IN M–1 TANKS

Senator PROXMIRE. What are the problems with the engine's fuel nozzles and transmission? These are some of the components identified as problem areas.

Mr. SHELEY. We've talked pretty much about the transmission. The primary problem was in the clutch. We would hope that that problem is on its way to solution.

Senator PROXMIRE. How about the fuel nozzle?

Mr. SHELEY. The fuel nozzle has been coking up. This is a result of when the engine is cutoff, the fumes still go through there. That leaves a debris that gradually builds up and ultimately will stop up the nozzle. Now, what they've been trying to do is to take that nozzle out periodically and soak it in some kind of solvent. It worked up to a point, but you can't get all of the buildup that's coking out of it, so they have to go back to the manufacturer to be recleaned.

They are now thinking about a solution to this with a type of a nozzle that can be disassembled, so that you can get to all of the insides of it. Therefore, you can put it in solvent, get it cleaned, put it back into like-new condition. But the principal problem is this coking around the nozzle itself which results from the fumes oxidizing.

Senator PROXMIRE. In the case of the M–60A2, who was the contractor and who will pay the costs of those defective tanks—the taxpayer or the contractor?

Mr. SHELEY. Chrysler was the contractor, and I'd say the taxpayer, as usual, pays the bill.

Senator PROXMIRE. The taxpayer gets stuck. What protection does the taxpayer have, in the event the M–1 turns out to be defective? Any? Will the taxpayer have to pay to recall them, as was done with the M–60A2, or fix them up as was done in the case of the C–5A? Or is the taxpayer protected by some sort of warranty in the contract?

Mr. SHELEY. He doesn't have much of a warranty, so in case we really get a bad problem, the taxpayer again is going to pay the bill.

Senator PROXMIRE. Give me a cost, then.

Mr. SHELEY. No, sir, this is a fixed-price incentive contract.

Senator PROXMIRE. The fixed price, but the price doesn't stay very well fixed, does it? If there is a problem, the taxpayer has to pay it.

Mr. SHELEY. If you make a modification, yes, sir, that is correct.

PRODUCTION DELAY COSTS

Senator PROXMIRE. In your judgment, do the M–1 contracts adequately protect the taxpayer by spelling out schedule and performance requirements for the tank and its components so if there are delays and failures, the Army will have recourse against the contractor?

Mr. SHELEY. They are spelled out in the contract and they are spelled out in almost every other contract I've looked at. But I don't see many cases where the contractor is penalized for not meeting schedule or performance criteria, unless it's built into the incentive provisions of the contract; and it is, in the case of the M–1. But these are primarily performance incentives. The tank probably will meet a good part of those performance incentives, and they will be paid.

Senator PROXMIRE. Let me make just a quick summary statement. We're about through, and I think you've done a splendid job in your presentation and in your responsiveness to the questions. But I am very, very concerned here, although the M–1, like every major weapons program, has plusses and minuses in its present stage. This Senator is extremely concerned, as a result of today's testimony. Several facts are just inescapable.

First, the Army has failed to do its logistics planning. Second, the results of the latest tests are very disappointing. Third, we already have shortages of support services in Europe. When these facts are viewed from the perspective of earlier failures, such as the M–60A2, which had to be recalled from Europe, every taxpayer has cause to worry about this program. Yet we need better tanks and improved readiness. The question is whether we achieve those objectives with the M–1.

Tomorrow we will hear the Army's side of the story when we hear from General Ball, General Lawrence, and General Maloney.

Gentlemen, thank you very much. The subcommittee will stand in recess until tomorrow morning.

[Whereupon, at 11:50 a.m., the subcommittee recessed, to reconvene at 10 a.m., Wednesday, July 22, 1981.]

THE M-1 TANK AND NATO READINESS

WEDNESDAY, JULY 22, 1981

CONGRESS OF THE UNITED STATES, SUBCOMMITTEE ON INTERNATIONAL TRADE, FINANCE, AND SECURITY ECONOMICS OF THE JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The subcommittee met pursuant to recess, at 10:10 a.m., in room 5110, Dirksen Senate Office Building, Hon. William Proxmire (vice chairman of the subcommittee) presiding.

Present: Senators Proxmire, Symms, and Jepsen; and Representative Richmond.

Also present: James K. Galbraith, executive director; Richard F. Kaufman, assistant director-general counsel; Charles H. Bradford, assistant director; and Chris Frenze and Keith B. Keener, professional staff members.

OPENING STATEMENT OF SENATOR PROXMIRE, VICE CHAIRMAN

Senator PROXMIRE. The subcommittee will come to order.

Gentlemen, we're delighted to have you here. And we're grateful for your appearance.

We had a hearing yesterday with the General Accounting Office, giving us some very strong and disturbing criticisms of the new tank, and very well documented.

I presume that you've had a chance to study their prepared statements. And we're anxious to hear what your response is.

We feel it's not only important as far as the M–1 tank is concerned, but this is, if not typical, it's something that happens much too often in our procurement system. We do have enormous cost increases, far greater than we had anticipated, and all kinds of great difficulties.

I realize that the technologies are new and so forth, but the unsatisfactory performance of the M–1 tank is something that troubles us very much.

Decisions will soon be made about whether to increase the rate of production of the M–1 tank. The requirement for a new tank and for greater numbers of tanks is well known. It is to meet the growing Soviet military buildup and the need to strengthen our forces in NATO.

The Army's testimony this morning will be accompanied by viewgraphs and charts. I think that's fine; but there is one chart that I believe everyone needs to ponder, because it tells it all.

It is a quote from the late Gen. Creighton Abrams, for whom the M–1, or the Abrams tank, was named. He said: "Basically, no requirement is so urgent that we produce unsatisfactory equipment to fill it."

Is the M–1 satisfactory or unsatisfactory? The best way we can answer that question, before deciding to put it into full production and use, is to test it.

Yesterday the General Accounting Office presented a rather dismal report of the Army's latest tests. This morning the Army has an opportunity to reply.

The witnesses are Maj. Gen. Duard Ball, program manager for the M–1 Abrams Tank System; Maj. Gen. Richard Lawrence, Commanding General of the 1st Cavalry Division; and Col. Edwin M. Aguanno, Deputy Director of the Weapons System, Office of the Deputy Chief of Staff for Research, Development, and Acquisition.

Gen. James Maloney, who was originally scheduled to appear, was taken ill yesterday.

Gentlemen, you may proceed and then the subcommittee will address some questions to you. Go right ahead.

STATEMENT OF COL. EDWIN P. AGUANNO,[1] DEPUTY DIRECTOR, WEAPONS SYSTEMS, OFFICE OF THE DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT, AND ACQUISITION, U.S. ARMY, ACCOMPANIED BY MAJ. GEN. ROBERT L. KIRWAN, COMMANDER, U.S. ARMY OPERATIONS, TEST, AND EVALUATION AGENCY

Colonel AGUANNO. Thank you, sir, for the opportunity to address you and your subcommittee on the concerns that you expressed in your opening statement.

We feel we do have information that should clarify, to a large extent, the implied uneasiness that you have with the tank that we would like to field.

In view of that, sir, we have the witnesses that you mentioned, and we've also brought with us three people you might be interested in knowing, who are in the audience.

One is General Kirwan, who is in charge of our operational test community, and two sergeants from Fort Hood, who can talk to the operational aspects as the tank commanders.

Senator PROXMIRE. Would each of these people stand as you introduce them so we can know who they are?

Colonel AGUANNO. First, General Kirwan.

Senator PROXMIRE. General, good to have you here.

General LAWRENCE. And two sergeants from my division, Sergeant First Class Braggs and Sergeant First Class Maggard.

Senator PROXMIRE. Good to have you with us, gentlemen.

Colonel AGUANNO. Continuing from there, sir, we are here to discuss the Army tank program, and I'm thankful to be given this opportunity.

During the course of our presentation, I will discuss the tank threat and the Army's tank strategy to counter that threat.

I will briefly highlight the Department's views on the M–1 tank and then I'll be followed by General Lawrence, and then General Ball.

General Lawrence, of course, will highlight the operational aspects.

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[1] The slides utilized in Colonel Aguanno's oral statement may be found at the end of his prepared statement.

Senator PROXMIRE. I take it, Colonel, that you're reading from a summary of the full statement?

Colonel AGUANNO. I'm paraphrasing from it; yes, sir.

Senator PROXMIRE. The prepared statement will be printed in the record in full. How long will your summary take?

Colonel AGUANNO. Sir, it takes about 6 minutes.

Senator PROXMIRE. Fine. Go ahead.

Colonel AGUANNO. Thank you, sir.

[Slide 1.]

OVERVIEW EVALUATION OF ARMY TANK PROGRAM

In 1977, the Army undertook a major review or study of its tank program, to insure that this Nation was fielding the best available tank in adequate numbers and in a timely manner to counter the threat.

The outcome of this review and study was the development of a blueprint for tank acquisition, a fleet mix, and production basis development, which in principle is being followed today to meet the requirements for the tanks indicated on the chart.

[Slide 2.]

Although the Army Acquisition Objective (AAO) designated 16,000 tanks—that number of tanks is required to equip and support the force during the initial stages of war—the quantity depends on the combat scenarios, which consider force structure and expected combat losses.

Then, of course, if we had increased number of units, the AAO would be changed.

While the Army's goal is to replace the entire AAO with the Abrams or its successors, the 1977 study realized that was a very ambitious goal. Therefore, we established a term and a requirement called the IOO, or the Initial Operational Objective. This was established in recognition of our inability to rapidly meet the Army acquisition objective because of costs, the size of the peacetime production base, the sizable investment represented by the tanks on hand, and the need to use available funds in a balanced way to equip, modernize, and sustain all elements of the Army, not just the tank units.

As a result of a congressional directive and combat simulations run to support the 1977 study, an IOO of 7,058 tanks was established. The original M–1 initial program object was, of course, 3,312.

However, the HASC, in their report, 94–194, dated in April of 1977, directed the Army to comprehensively restructure its procurement program to increase the production quantity of XM–1's (now M–1) to between 7,500 and 8,000, to reduce the near-term risks until the Abrams production base was proven and the tank fielded in numbers. The study recommended the upgrade of M–60 tanks.

The Army approved that recommendation and called that improvement the M–60A3. The current Army program calls for fielding of 3,816 A3's by the 1986 timeframe. Of that total, 1,686 will be newly produced, and 2,130 will be converted tanks.

[Slide 3.]

In the fiscal year 1982 posture statement by the Chairman of the Joint Chiefs of Staff, he called attention to current and future trends in tank inventories, as illustrated on the current chart.

In addition, he emphasized the continuing modernization of the Soviet and Warsaw tank fleets.

Senator PROXMIRE. That chart has no vertical figures. Can you just tell us, roughly—

Colonel AGUANNO. Yes, sir. The U.S.S.R. number would be about 47,000 tanks. That would be the number for their total tank fleet.

Senator PROXMIRE. The U.S.S.R. now would be 47,000?

Colonel AGUANNO. Yes, sir. Of those, about one-third would be considered the modern versions, and about two-thirds would be considered the somewhat antiquated, but very effective tanks.

Senator PROXMIRE. So that about 16,000 would be modern?

Colonel AGUANNO. Of the modern versions, yes, sir.

Senator PROXMIRE. What's the number for NATO?

Colonel AGUANNO. We have that, sir, but that would be classified and we were not given classified clearance in this forum.

Senator PROXMIRE. That's the reason you don't have the numbers on the chart, I take it?

Colonel AGUANNO. That's correct, sir.

Senator PROXMIRE. All right.

Colonel AGUANNO. For at least the next decade, the U.S. tank fleet will consist of a high-low mix of Abrams and M–60 tanks. The Abrams tank is definitely superior to the latest Soviet tanks, known as the T–64 and the T–72, and at least comparable to the T–80, which is nearing production now.

The T–64 and the T–72 are believed to outmatch the M60 series tanks, principally due to the greater armor protection and their 125 millimeter cannons.

But regardless of this, the M–60 tank series, particularly the M–60A3 with its improved fire control, outmatched the majority of the Soviet tanks other than the T–64 and the T–72, and will be the mainstay of our force until we can get the Abrams tank to our front line units in numbers.

Now, if we are to succed in battle against this numerically superior foe, we must have a weapons system that can conduct timely offensive operations or counterattacks. From the Army's perspective, the Abrams tank is mandatory for spearheading those vital operations.

[Slide 4.]

This next viewgraph that comes on now illustrates the change in fleet mix over time, as the Abrams is phased into the inventory and as we gradually build up to the Army's acquisition objective, the AAO.

As the Abrams tanks build up, we will purge the fleet of the least capable and older tanks.

M–1 ACQUISITION PROGRAM

With that overview, I would like to briefly address the M–1 acquisition program.

[Slide 5.]

Since 1972, the Army's objectives for the Abrams tank program have been to develop a significantly improved tank for the 1980's and beyond, to produce the first production model in 7 years, and to do it within a hardware cost ceiling.

At this point, it appears we have accomplished most of the goals we have set for ourselves. The M–1 program manager, of course, will

address the specifics, as I mentioned before. But I want to emphasize that accomplishment of the M–1 objectives demanded some calculated program concurrency, concurrency in testing and integrated logistic development and support, concurrency in developing and facilitization of the production base.

This acquisition strategy was not without risk. It accounts for some of the problems that we have had to solve while the spotlight was on our every move. We subjected the M–1 tank to unprecedented testing demands because we wanted to deliver to our soldiers not only a winner in an operational sense, but also a tank that is reliable and maintainable. And we will depict how we achieve that goal.

Since 1975, over 200,000 miles have been accumulated and over 37,000 main gun rounds expended by 75 M–1 tanks in environments ranging from Alaska to the desert. The majority of testing is complete. However, an additional 60,000 miles and approximately 4,000 main gun rounds of testing remain to be done. This additional testing is primarily to address additional factors of reliability, availability, maintainability, and durability, frequently referred to as RAM–D, as part of our planned RAM–D maturity growth program for the M–1.

As a result of this extensive testing, a number of problems have been found and effectively solved. Based on the latest testing, during DT/OT III, the analysis of which is not yet complete, it appears except for power train durability and track life—to some small all RAM–D requirements will be met prior to the end of testing, except for power train durability and track life—to some small degree, maintenance ratio—three factors that we feel have not quite met our original objectives.

The PM will address each of these. However, these limited shortfalls do not constitute a significant degradation in any way in either operational effectiveness or create unacceptable operating and support costs.

Production at the Lima Army tank plant has been slower than expected. A variety of production startup problems have contributed to this delay. However, we believe, along with Chrysler, that the aggressive action taken to resolve those problems is really beginning to pay dividends. We fully expect to make the production plan for 569 tanks for 1981, while at the same time providing adequate equipment to support training and logistical requirements.

[Slide 6.]

The M–1 cost story we feel is a good one, coming very close to our expectations, even though the total program costs have greatly increased. We doubled the number of tanks to be produced, and inflation has been much more severe than expected—and we'll describe that.

ACQUISITION AND OPERATING COSTS

When you properly compare the M–1 costs, using the same-year dollars and identical cost definitions, the significance of the critics' cost comparisons wane significantly and quickly.

The current unit hardware estimate was changed for the following reasons: First of all, a quantity increase; then a production rate increase; an assembly plant increase; and the addition of the 120 millimeter gun on some tanks.

Had these changes not been made, the current unit hardware estimate, in constant 1972 dollars, which is the base year for com-

parison would be $504,100. These estimates are averaged over the entire buy of the 7,058 tanks that we showed as our IOO. The program acquisition unit cost estimate is larger, because this definition includes many more cost elements. It includes an amortized portion of all R.D.T. & E. cost, initial production facilities costs, initial spares and repair parts cost, and test training and support equipment costs.

As a basis for comparison, we estimate the M–60A3 hardware unit cost to be $1.2 million for the M–60A3, in fiscal year 1982 dollars.

A further comparison is shown on the chart comparing annual unit operating costs for the M–1, the M–1E1, which is the M–1 equipped with the 120 millimeter tank gun, and the M–60A3. Once in the field, we do not expect a major operating cost difference between these three tanks. The operating costs will be very nearly the same for all three.

The massive Soviet effort to modernize its tank forces tells us that we are fielding the Abrams tank none too soon. It also tells us that we must plan to upgrade the Abrams over time if we are to keep pace, particularly to face the T–80 follow-on.

In spite of these realities, the Army has been and continues to be subjected to heavy criticism. Had we followed the advice of certain critics, we would not be fielding the Abrams tank until the mideighties or later. In the meantime, we can be sure Soviet tank modernization will continue relentlessly.

I am pleased to say that the Congress has accepted the Army's arguments in the past and has permitted us to proceed, in spite of the sometimes rocky road that we have been traveling for a complex system. I believe the confidence and trust you have placed in us will be justified again by the testimony of the witnesses we've brought here today.

Overall, the story is a very positive one. notwithstanding a few areas which require more work.

In short, the Abrams tank is a fine tank now. And we need to proceed expeditiously with our fielding preparations.

With that, I'd like to turn it over to General Lawrence.

[The prepared statement of Colonel Aguanno follows:]

PREPARED STATEMENT OF COL. EDWIN P. AGUANNO

Senator Proxmire and members of the subcommittee, I and the other witnesses, MG Lawrence and MG Ball, are here today to discuss the Army's tank program. During the course of our presentations, I will discuss the tank threat and the Army's tank strategy to counter it. I will briefly highlight the Department of the Army views on the M1, and be followed by MG Ball, the M1 project manager (PM), who will discuss the M1 tank program in greater detail. In addition to General Ball, we have with us MG Lawrence who is the 1st Cavalry Division commander, at Fort Hood, Texas, the only operational unit in the Army to have the new Abrams tank, as well as the older M60's. General Lawrence will highlight the operational aspects of each tank and the recently completed M1 tests conducted at Fort Hood.

Slide 1.—Army tank program

In 1977, the Army undertook a major review of its tank program to insure that this Nation was fielding the best available tank force in adequate numbers and in a timely manner to counter the threat. The outcome of this review was the development of a blueprint for tank acquistion, fleet mix, and production-base development which, in principle, is being followed today to meet the requirements for tanks indicated on this chart.

Slide 2.—Tank requirements

The Army acquisition objective (AAO) is the quantity of tanks authorized for peacetime acquisition in order to equip and support the force during the initial stages of war. The quantity depends on combat scenarios which consider force structure and expected combat losses.

While the Army's goal is to replace the entire AAO with the Abrams or its successors, the 1977 study realized that was an ambitious goal. Therefore, an Initial Operational Objective (IOO) was established in recognition of our inability to rapidly meet the Army Acquisition Objective because of cost, the size of the peacetime production base, the sizeable investment already made in tanks on hand, and the need to use available funds in a balanced way to equip, modernize, and sustain all elements of the Army. As a result of a congressional directive and combat simulations run to support the 1977 study, an IOO of 7,058 M1 tanks was established. The original M1 Initial Program Objective was 3,312 tanks; however, the HASC in their report No. 94–194, dated 7 April 1977, directed "The Army to comprehensively restructure its program for procurement" to increase the production quantity to "between 7,500 and 8,000 XM–1 tanks".

To reduce the near term risks until the Abrams production base was proven and that tank fielded in numbers, the study recommended the upgrade of some M60 tanks. The Army approved that recommendation and called that improvement the M60A3 tank. The current Army program calls for fielding 3,816 M60A3's by the end of fiscal year 1986. Of that total, 1,686 will be newly produced tanks and 2,130 will result from the conversion of older M60A1's to the A3 configuration.

Slide 3.—Tank inventories

In his fiscal year 1982 posture statement, the Chairman of the Joint Chiefs of Staff called attention to current and future trends in tank inventories as illustrated on this chart. In addition, he emphasized the continuing modernization of Soviet and Warsaw pact fleets.

For at least the next decade, the US tank fleet will consist of a high-low mix of Abrams and M60 series tanks. The Arbams tank is definitely superior to the lastest Soviet tanks; the T–64, and T–72, and at least comparable to the T–80. The T–64 and T–72 in turn are believed to outmatch our M60 series tanks, principally due to greater armor protection and their 125mm cannons. Regardless of this, the M60 series tanks, particularly the M60A3 with its improved fire control, outmatch the majority of the Soviet tanks and will be the mainstay of our force until we can get the Abrams out to our front line units in numbers.

If we are to succeed in battle against this numerically superior foe, we must have a weapon system that can conduct timely offensive operations or counter-attacks. From the Army's perspective, the Abrams is mandatory for spearheading those vital operations.

Slide 4.—Fleet profile

This vugraph illustrates the change in fleet MIX over time as the Abrams is is phased into the inventory and we gradually build up to the Army acquisition objective. As Abrams build up, we will purge the fleet of the least capable and older tanks.

With that an overview, I would like to briefly address the M1 Abrams acquisition program.

Slide 5.—M1 objective

Since 1972, the Army's objectives for the Abrams tank program have been to develop a significantly improved tank for the 1980's and beyond; to produce the first production model in seven years; and do it within a hardware cost ceiling. At this point, it appears we have accomplished most of the goals we set for ourselves. The M1 program manager will address the specifics; but I want to emphasize that accomplishment of the M1 objectives demanded some calculated program concurrency; concurrency in testing and integrated logistics support development, and concurrency in the development and facilitization of the production base. This acquisition strategy was not without risk, and it accounts for some of the problems that we have had to solve while the spotlight was on our every move, and we subjected the M1 to unprecedented testing demands because we wanted to deliver our soldiers not only a winner in an operational sense, but also a tank that is reliable and maintainable.

Since 1975, over 200,000 miles and 37,000 main gun rounds have been accumulated by 75 M1 tanks in environments ranging from Alaska to the desert. The majority of the testing is complete; however, an additional 60,000 miles and

4,000 main gun rounds of testing remain. This additional testing is primarily reliability, availability, maintainability, and durability (RAM–D) in nature, and is part of our planned RAM–D maturity growth program for the M1.

As a result of this extensive testing, a number of problems have been found and effectively solved. Based on the latest testing, DT/OT III, which is it not yet complete, appears all RAM-D requirements will be met prior to the end of testing except for power-train durability and track life. The PM will address each of these areas: However, even this limited shortfall does not constitute a significant degradation in either operational effectiveness or create unacceptable operating and support costs.

Production at the Lima Army Tank Plant has been below expected rates. A variety of production start-up problems have contributed to the delay; however, we believe the aggressive action taken to resolve these problems is beginning to pay off. We fully expect to make the 1981 production plan for 569 tanks, while providing adequate equipment to support training and logistical requirements.

Slide 6.—M1 cost story

The M1 cost story is a good one, coming in very close to our expectations, even though total program costs have greatly increased because we doubled the number of tanks to be produced and inflation has been more severe than expected. When you properly compare M1 costs using the same year dollars and identical cost definitions, the significance of the critics cost comparisons wane quickly.

The current unit hardware estimate was changed for the following reasons: A quantity increase; a production rate increase; an assembly plant increase; and the addition on some tanks of a 120mm gun. Had these changes not been made, the current unit hardware estimate in constant 1972 dollars would be $504,000. These estimates are averaged over the entire buy of 7,058 tanks.

The program acquisition unit cost estimate is larger because this definition includes many more cost elements, including an amortized portion of all RDT&E costs, initial production facilities costs, initial spares and repair parts costs, and test, training and support equipment costs.

As a basis for comparison, we estimate the hardware unit cost estimate for the M60A3 in fiscal year 1982 dollars to be $1.2 million. A further comparison is shown on the chart comparing annual unit operating costs for the M1, M1E1 includes the 120mm gun) and the M60A3. Once in the field, we do not expect a major operating cost difference between these three tanks.

The massive Soviet effort to modernize its tank forces tells us that we are fielding the Abrams tank none too soon. It also tells us that we must plan to upgrade the Abrams over time if we are to keep pace. In spite of these realities, the Army has been and continues to be subjected to criticism. Had we followed the advice from critics, we would not be fielding the Abrams tank until the mid-1980's. In the meantime, we can be sure Soviet tank fleet modernization will continue relentlessly.

I am pleased to say that the Congress has accepted the Army's arguments in the past and permitted us to proceed in spite of the sometimes rocky road we have been traveling. I believe the confidence and trust you placed in us will be vindicated again by the testimony of the witnesses here today. Overall the story is a very positive one, notwithstanding a few areas which require more work. In short, the Abrams tank is a fine tank now, and we need to proceed expeditiously with our fielding preparations.

Slide 7.—Abrams product improvements

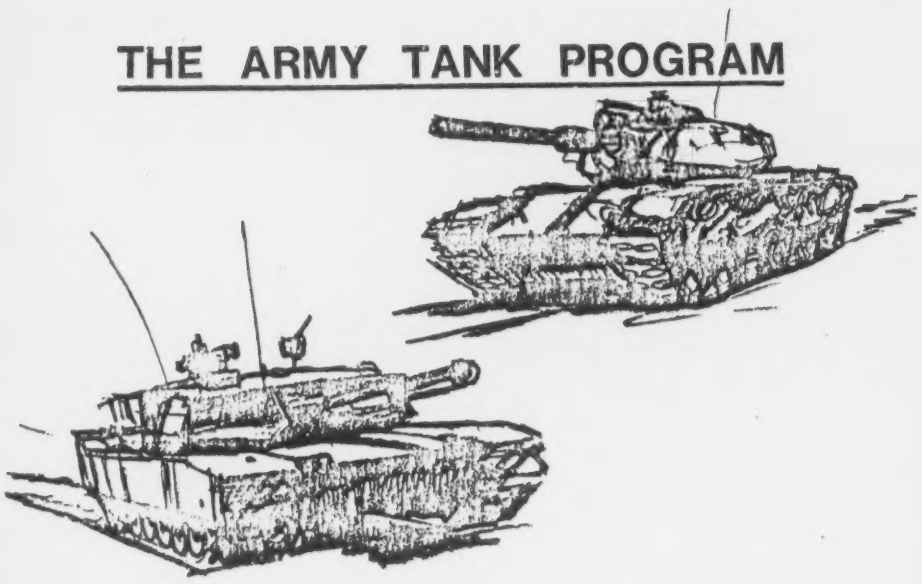
Now that we have designed and are preparing to field the first generation Abrams tank, we need to get on with our program to do research and development for planned evolutionary improvements that will help it keep pace with the growing threat. This chart identifies the major improvements we plan to incorporate into the Abrams tank. The 120mm gun, chemical protection improvements, and the auxiliary power unit have received congressional support in the past. Information on the toughness of the T–64 and T–72 make the 120mm up-gunning of our M1 tank look even more essential; and of course the Soviet chemical threat demands that we do our very best to defend against it. These programs need to continue. Again this year we are seeking your support to initiate an armor improvement program.

Prior to leaving the M1, I want to emphasize to you just how favorably the troops have received the Abrams tank. I am sure General Lawrence will discuss it, but you can easily sense the increased morale and esprit de corps our soldiers have when they work with the Abrams—the best tank fielded in the world today.

Now, Mr. Chairman, with your permission, I would like to ask the other witnesses to present more detail concerning the Army's tank program.

SLIDE 1

THE ARMY TANK PROGRAM



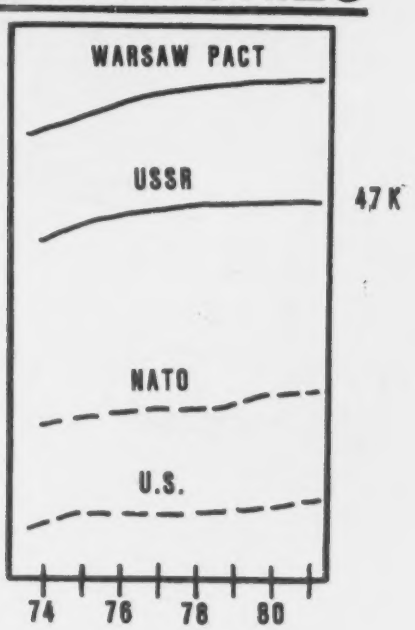
SLIDE 2

TANK REQUIREMENTS

ARMY ACQUISITIONN OBJECTIVE -	16,227
ABRAMS TANK INITIAL OPERATIONAL OBJECTIVE -	7,058
M60A3 CURRENT OBJECTIVE	3,816

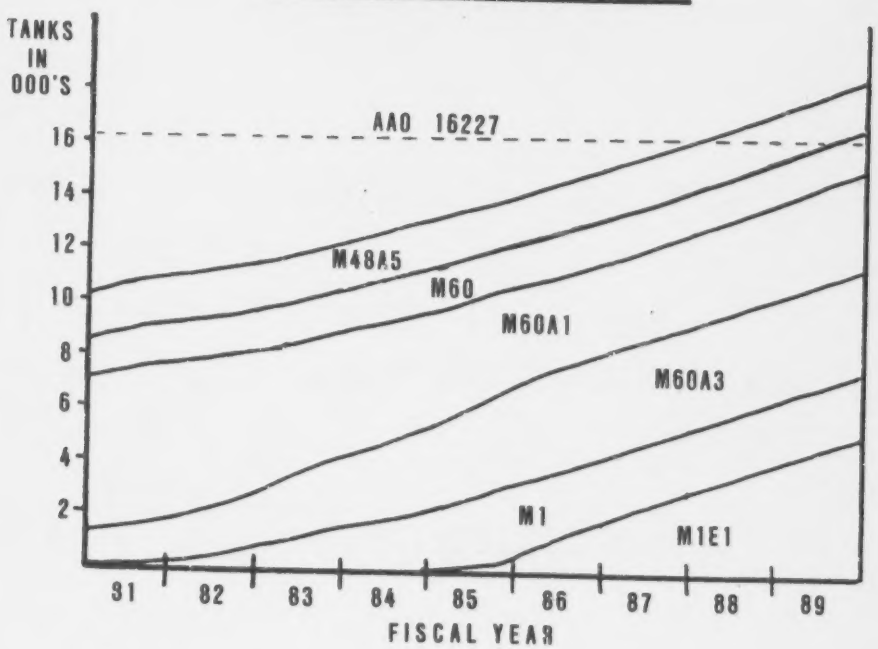
SLIDE 3

MEDIUM AND HEAVY TANK INVENTORIES



SLIDE 4

FLEET PROFILE



SLIDE 5

ABRAMS TANK PROGRAM OBJECTIVES

- DEVELOP AND FIELD A TANK FOR USE IN THE 1980'S AND BEYOND
- FIELD THE ABRAMS TANK IN SEVEN YEARS
- ACHIEVE SIGNIFICANT IMPROVEMENTS IN :
  - SURVIVABILITY
  - MOBILITY
  - FIREPOWER
- BE WITHIN DESIGN-TO-COST CEILING

SLIDE 6

M1 COST SUMMARY

(DOLLARS EXPRESSED IN THOUSANDS)

	72C$	82C$	ESC$
ORIGINAL UNIT HARDWARE GOAL	507.8	1616.5	1971.0
CURRENT UNIT HARDWARE ESTIMATE	530.5	1689.0	2106.0
CURRENT PROGRAM ACQUISITION UNIT ESTIMATE	720.9	2294.9	2628.5

	M1	M1E1	M60A3
ANNUAL UNIT OPERATING COST (82C$)	310.6	338.2	308.2

SLIDE 7

ABRAMS TANK MAJOR PRODUCT IMPROVEMENTS

- 120mm GUN ABRAMS TANK
- CHEMICAL PROTECTION
- AUXILLARY POWER UNIT
- ARMOR UPGRADE

Senator PROXMIRE. Thank you. General, go right ahead.

STATEMENT OF MAJ. GEN. RICHARD LAWRENCE, COMMANDING GENERAL, 1ST CAVALRY DIVISION, U.S. ARMY, FORT HOOD, TEX., ACCOMPANIED BY SFC. ROBERT C. BRAGGS; AND SFC. MICHAEL MAGGARD

General LAWRENCE. Senator, I'm Gen. Richard Lawrence, commander of the 1st Cavalry Division at Fort Hood, Tex. My group has been conducting a final troop evaluation of the M–1 Abrams tank for the past 10 months.

As commander of an armored division, my principal mission is to prepare my soldiers and their equipment for combat operations.

M–1 TESTING AND EVALUATION AT FORT HOOD

With your permission this morning, I want to spend a few minutes with you to relate to you some of the experiences we have had with the Abrams tank and share with you conclusions that we've drawn while comparing the Abrams to the M–60A1.

I have four armor battalions in the division. Three of the battalions are equipped with the M–60A1 tanks and the fourth has the M–1 Abrams tank. Crewmen of the Abrams tank battalion have operated exclusively with the M–60A1 prior to receiving the Abrams tanks and undergoing transition training. Therefore, these crews have considerable experience with both tanks and can readily draw realistic comparisons.

Our troop evalution of the Abrams tank was conducted primarily to determine operational suitability and logistic supportability of the system in the hands of soldiers. The major portion of that evaluation culminated in May, with the 96-hour field exercise for the battalion simulating combat scenarios in Europe against a representative opposing force. Based on my operational experience, the scenario we executed is likely to match or exceed the most stressful and arduous missions we would accomplish in combat.

In training for the field exercise during the preceding 8 months, the M–1 tanks in the battalion accumulated 35,000 miles and about 8,000 hours of engine operation. We fired over 7,000 rounds of main gun ammunition. Preparatory training conducted during that period was more sustained, strenuous, and demanding than the training afforded my typical M–60 units. I estimate we accumulated more mileage on my M–1's in 6 months than we do on the M–60's in over a year.

I'll be brief in my appraisal of the operational suitability of the Abrams tank. I've been a tank officer for 28 years. I'm familiar with most of the main battle tanks of the world's major armies.

OPERATIONAL SUITABILITY

In my view, by every measure of operational performance, the Abrams tank is an unequivocal winner. For example, my troops believe the M–1 Abrams is easier to maintain than the M–60 tank. We shoot better with the Abrams at night than we do with our M–60's in daytime.

An M–1 unit can cross a chaotic battlefield at better than twice the speed of an M–60 unit in order to concentrate at the decisive point to achieve victory.

I might add that the speed of an M–1 unit will allow commanders to wait longer in committing that unit to assure a more accurate estimate of the situation.

And based upon extensive survivability testing of the Abrams, we know that it will take hits which would catastrophically destroy an M–60 and continue to fight. Believe me, sir, my troopers understand the difference very well. Survivability has the biggest impact on a soldier's confidence, and confidence breeds fighting effectiveness.

MAINTENANCE AND LOGISTICS SUPPORTABILITY

One of the least understood factors in evaluating the M–1 tank is logistics supportability. It's probably less amenable to definitive examination than operational characteristics. But I believe that we were able to capture some useful and realistic data on our maintenance and logistics support plan during the troop evaluations.

Considerable data remain to be reduced, but some significant experimental results have already emerged from the battalion's field operations. For example, maintenance support is no different than that currently used for our other tank battalions.

We have an organizational maintenance capability within the battalion, a backup direct support capability at division level, and general support depot capability above the division.

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Within my division, during the entire evaluation period, all maintenance actions were performed by Army mechanics with commensurate skill levels. We actively accomplished maintenance actions with the M–1 battalion, using three less tank mechanics than in the conventional M–60 battalion.

Senator PROXMIRE. What does that mean percentagewise when you say "three less"? How many do you usually use?

General LAWRENCE. Sir, I run about 90-some-odd mechanics in an M–60 battalion.

Senator PROXMIRE. About a 3-percent reduction.

General LAWRENCE. Approximately 3 percent, yes, sir.

Senator PROXMIRE. Thank you.

General LAWRENCE. At the direct support level, we did not experience a need for additional repairmen. Some maintenance jobs at that level took a bit longer because of the inexperience of our personnel who were freshly trained and acutely concerned about quality assurance on a new system. The M–1 system does have more test equipment, but we have not experienced a need for more forward manpower requirements as a result. Actually, the M–1 has far fewer special tools than the M–60, which eases the training burden.

And for over 2,000 maintenance incidents recorded, every function was determined to be capable of being accomplished at the level of maintenance which we predicted.

For several maintenance functions, our experience suggests that responsibility for some of the component replacement actually can be moved to a lower maintenance level.

Also, our mechanics assimilated M–1 training very well. After receiving 186 hours of initial instruction on the Abrams—that's roughly 4½ weeks—track vehicle mechanics were evaluated to determine their proficiency at troubleshooting and repair. For all mechanics tested on completion of all tasks, over 80 percent received above-average or average scores.

I said earlier that my troops believe the M–1 is more easily maintained than the M–60. Because of modular components and major assemblies on the Abrams, organizational maintenance man-hours for many maintenance actions appear to be reduced. For example, we can remove the M–1 engine transmission package in half the time that it takes us to remove that same package from an M–60.

About 70 percent of the engine accessories and components can be replaced on the M–1 without removing the engine. But to replace even a small generator on the M–60 requires engine removal.

Throughout the stressful period of field training preparatory to the operational evaluation, we were still able to maintain or sustain operational rates of over 80 percent on the Abrams tank. Last week that rate was about 89 percent.

The majority of our mechanics believe that the test measurement and diagnostic equipment is very simple to use. We did find some inconsistencies and incomplete false diagnoses on organizational test sets during the period of evaluation, but the problem appeared to be a correctable software problem, not a hardware failure. Our direct support test set, on the other hand, had 95 percent correct fault diagnosis.

The built-in test equipment on the Abrams tank, which is not a feature of the M–60, was determined to be very satisfactory. We experienced 90 percent correct recordings for on-board malfunctions. This feature also helps preclude the probability of more serious faults arising from an undetected minor malfunction.

We also experienced favorable supply results during the field evaluation. An M–60 battalion normally carries 17,200 gallons of fuel in its authorized resupply vehicles. Of this, most tank battalions will load about 13,600 gallons of diesel fuel for their tanks. During the very stressful 96-hour period that I described earlier, our M–1 battalion task force carried 14,300 gallons of diesel in its resupply vehicles, about 700 gallons more than normal. With this, we did not experience a refueling problem, and we were able to fight all day without halting to refuel. This is the logistical performance measure we seek on the battlefield and the same capability we have in the M–60.

We did experinece greater M–1 fuel consumption, but it should be remembered that the M–1 has double the horsepower of the M–60. It will take us places the M–60 cannot go, with greater agility and at higher speeds. That equates to survivability, enhancing our ability to fight outnumbered and win.

Finally, a measure of our optimism for properly supporting the M–1 with fewer repair parts than anticipated has been demand experience for parts over the training and evaluation period.

The initial authorized stockage list for repair parts provided by the project manager included about 2,100 separate line items. This was based on an original engineering estimate by the contractor and by the project manager. As a result of fewer demands recorded than anticipated over the past 10 months, we've reduced that required list of repair parts for direct support stockage to about 840. And the parts lists stored in our M–1 tank companies have also been reduced substantially.

In conclusion, sir, troops and I enthusiastically endorse the Abrams tank. We are confident of its superiority and its field performance. Should we have to fight, we'll win with it on the battlefield.

Our only concern now is to have it in our inventory as quickly as possible and in the quantity that we desperately need.

Senator PROXMIRE. Thank you, General Lawrence.

General Ball.

STATEMENT OF MAJ. GEN. DUARD D. BALL,[1] PROGRAM MANAGER, ABRAMS TANK SYSTEM, U.S. ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND

General BALL. Senator Proxmire, members of the subcommittee, I am pleased to have this opportunity to report to you on the status of the Abrams tank program. With your permission, I will present a brief statement, addressing the background of the program, system performance and our production status. After that, I'll be happy to respond to any questions you may have.

[Slide 1.]

[1] The slides utilized by Major General Ball may be found at the end of his oral statement.

BACKGROUND OF M–1 TANK PROGRAM

Simply stated, our objective has been to provide the main battle tanks the Army needs to meet the threat of the 1980's and beyond. The original requirement was established in 1972 by the Army tank special study group, after detailed analyses of the threat projected for the 1980's.

The Army presented a 10-year development program in 1972. However, as Colonel Aguanno has mentioned, the Congress directed the new tanks be brought into production in 7 years due to the urgency of the requirement. This was accomplished on schedule, and the first Abrams tank rolled off the production line at Lima, Ohio, in February 1980. The IOC, the initial operational capability, was achieved in January 1981, when the first company was declared operational at Fort Hood, Tex.

In retrospect, this schedule compression and the difficulties it has imposed have been justified. We see the threat projected in 1972 materializing as the Soviet Union produces and fields increasing number of modern tanks. The M–60 tank has served us well for over 20 years, but we now need a tank with qreatly improved operational capabilities. The most extensive and demanding tests we've ever required of a combat vehicle have shown that the Abrams tank meets the need now and has the potential for continued improvement.

[Slide 2.]

SYSTEM PERFORMANCE

The key performance requirements for this tank were also established in 1972 as materiel needs, or MN, as shown on this chart. Recognizing that tradeoffs would be necessary to optimize system capabilities within budget guidance, the most critical characteristics were prioritized to guide the developmental contractor. This chart shows these characteristics in order of priority. As indicated by the green coding tests have shown that the Abrams meets or exceeds the requirements established for most characteristics.

Crew survivability appropriately has been allocated No. 1 priority and has had the greatest effect on the design of the tank. This revolutionary system combines armor of a special design, compartmentalization of ammunition and fuel, flame resistant hydraulic fluid, and an automatic fire detection and suppression system to provide unprecedented protection. Effectiveness of these systems has been demonstrated conclusively through testing of both test structures and fully combat-loaded tanks against a variety of representative threat munitions, including small arms, large caliber antitank munitions and antitank mines. The results are impressive evidence of this tank's unparalleled protection of its crewmen.

Superior fire control objectives have been attained through the use of a digital computer-based fire control system, which features stabilization of the sight and weapon, a laser rangefinder, and a thermal imaging system for use during periods of darkness or reduced visibility. This highly effective fire control system enables the crew to engage targets with an excellent probability of achieving a first-round hit and kill, while moving cross country at relatively high speeds. This capability, combined with the extraordinary mobility

and agility, gives the Abrams a valuable advantage over other known tanks.

You will note that we have not met the operating range requirement. This requirement was set in the MN in 1972 at 275 miles, traveling at 25 miles per hour on level secondary roads. This requirement was met during earlier testing. However, an increase in track tension to improve retention resulted in increased rolling resistance and decreased fuel economy. Current test data indicate an operating range under the prescribed conditions of from 215 to 250 miles under those same conditions.

I would comment that with six tanks tested, five averaged 250 miles. And you don't get the reason for the degraded fuel economy on that. There are some anomalies in the limited test data available which will require more testing and analysis.

It is significant that at 25 miles per hour the transmission is normally not operating in its most effective gear range. This tank typically travels at speeds well above 30 miles per hour on level secondary roads. At these speeds, the transmission and the turbine engine are operating more efficiently, resulting in a range capability of over 275 miles. Thus, we expect the actual impact of this shortfall to be less than the test results would indicate. We are concerned with improving fuel economy and have a developmental program underway which shows promise of achieving about a 10-percent improvement.

Although not an MN requirement, we are concerned also that the tank be able to complete a 24-hour combat day without refueling. This capability has been demonstrated in operational tests at Fort Knox and Fort Hood.

Of the remaining characteristics, we have met requirements for all except the last, logistics support. Difficulties in troubleshooting have precluded our realization for the exceptional maintainability inherent in the design of this system. Many factors have contributed to this condition: Lack of experience with the system and with automatic test equipment—this is the first combat vehicle for which we've fielded automated test equipment: training limitations—General Lawrence mentioned the 186 hours; and imperfections in the a manuals and test equipment.

All of these have shown up in testing at one time or another. Improvements have been made, and the unit operational tests at Fort Hood have demonstrated that soldiers can troubleshoot and repair the tank, although deficiencies in manuals and test sets have caused some problems.

We believe that further improvement is essential and have placed a high priority on doing so. We have a special task force of government and contractor people assigned to the specific task of bringing our manuals and test sets up to full effectiveness. Good progress is being made, and we expect to have overcome most problems by the time the first battalions in Europe become operational. I am confident that we will capitalize on the full potential of the automatic test equipment and the designed-in maintainability of the tank.

[Slide 3.]

Shown on the next chart is our current status of the 13 reliability, availability, maintainability, and durability (RAM–D) parameters we are assessing. This chart shows the RAM–D parameter on the left, the

requirement in the center, and the "as tested" status on the right. By "as tested," I mean that it's based on averaged data from the test site prior to evaluation of the effectiveness of corrective actions. As you can see by the green, we're doing well overall. We are where we had expected to be at this stage of testing, with two exceptions:

First is power train durability. Our requirement is to achieve a 0.5 or 50 percent probability of going 4,000 miles without a power train failure. Our current "as tested" status is 0.2, or 21 percent probability of going that 4,000 miles without having to replace the power train component. A major contributor to this shortcoming has been failures of the clutches in the transmission. This was found to be a design weakness, and we have successfully tested a fix which will go into production in September.

When considering this and additional design improvements that have been made, previous experience leads us to expect that we will achieve about a 0.4 probability by the end of testing. Based on the improvements that have been made on the production line and additional design improvements that are currently being made to the engine, I fully expect that the Abrams will meet this power train durability requirement in full production.

The second exception is track life. The requirement was to have a track life of 2,000 miles. That was established in 1972. We are currently achieving about 1,000 miles. I feel that we're up to the state of the art in this area and therefore do not expect to see any significant improvement in the near term. We have developmental efforts underway and will continue to explore opportunities for greater track durability.

In maintenance ratio, we are currently achieving 1.7, against a requirement of 1.25. The significant factors contributing to this shortfall have been the initial shortfall in test sets, manuals, and training. I previously addressed the actions taken in those areas in my discussion of logistical support. Based on the corrections that are being made, I believe that we will meet the maintenance ratio requirement in fielded systems after 1981.

[Slide 4.]

PRODUCTION STATUS

Turning now to production, this chart displays our production plan in cumulative deliveries. The fiscal year indicates the budget year in which projected deliveries are funded.

Although the first delivery milestone was met, a number of startup problems have caused slippages in subsequent deliveries. For the most part, the nature of these problems have been characteristic of any major startup, even though the severity has been greater.

This is a radical departure in tank manufacture, and the learning curve has been flatter than we had anticipated. The major pacing item has been engine availability. I am encouraged by recent progress in this area, however. The subcontractor delivered 29 engines in June, and we forecast over 30 in July with continued growth until we reach planned monthly production rates for 60 engines this spring. Other component and assembly deliveries are adequate to support our production plan.

Notwithstanding this improvement in deliveries, I am concerned for the delay in production maturation resulting rom earlier constraints. For this reason, we have made a reduction in the projected rate of production growth. With this reduction, we anticipate a slippage of about 45 days in the third year—that is, the fiscal 1981 funded year deliveries from the end of January 1983 to mid-March 1983.

With experiences to date, I believe the Army is in a position to provide a production schedule which accurately reflects prudence, realism, and achievability. The schedule I am showing you today is characterized by continued increasing tank deliveries based in the near term on engine availability, supportability of spares, training and fielding requirements, realistic buildup of deliveries from both plants—that is, the Lima army tank plant and starting next March, the Detroit army tank plant—and no unnecessary risk assumptions. I believe it is achievable at moderate overall risk. Most importantly, it fields the tanks our soldiers need as soon as it is practicable.

In summary, I believe that the Abrams tank has proven to be an extraordinarily effective combat tank—not perfect, but we will make it better. But it provides a quantum improvement over all alternatives. It excels in all key aspects of operational effectiveness. I am convinced, it is the best tank in the world today, and I respectfully request your continued support of this program. Thank you.

[The charts referred to by General Ball follow:]

SLIDE 1

M1 PROGRAM OBJECTIVE

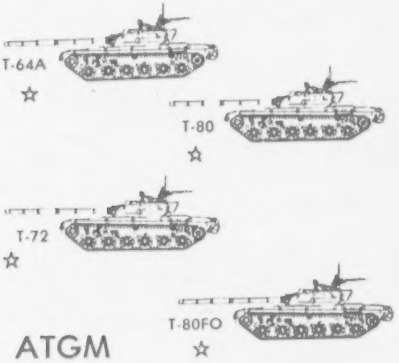
MEET THE THREAT

SURVIVABILITY

MOBILITY, AGILITY, FIREPOWER

RAM-D

1980's & BEYOND



ATGM

AIR

HIND-D

SLIDE 2

M-1 ABRAMS

MN CHARACTERISTICS

USER PRIORITIES	STATUS
1. CREW SURVIVABILITY	☐ OK
2. HIT PROBABILITY	☐ OK
3. TIME TO HIT/KILL	☐ OK
4. AGILITY	☐ OK
5. X-COUNTRY MOBILITY/RANGE	☐ RANGE
6. COMPLEMENTARY WEAPONS	☐ OK
7. SYSTEM INTEGRATION	☐ OK
8. EQUIPMENT SURVIVABILITY	☐ OK
9. PHYSICAL DIMENSIONS	☐ OK
10. SIGNATURE REDUCTION	☐ OK
11. LOG SPT, TMDE, SPT-EQPT	☐ OK IN TIME FOR EUROPEAN FIELDING.

SLIDE 3

M-1 ABRAMS

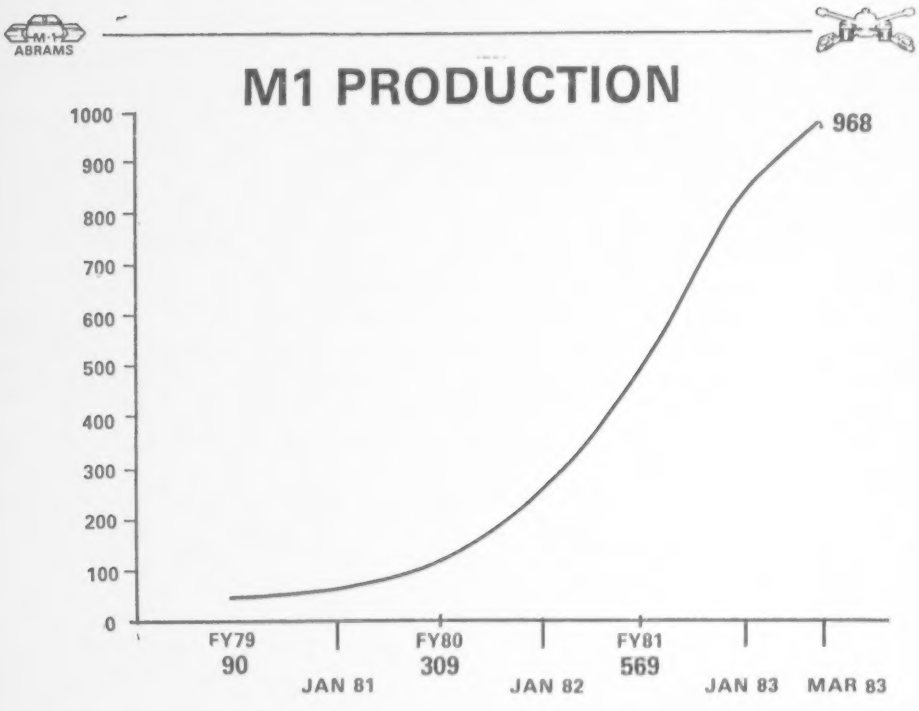
2 JULY 1981

RAM-D PARAMETERS/STATUS

PARAMETER	REQUIREMENT	STATUS
COMBAT RELIABILITY	320 MMBF	276
SYSTEM RELIABILITY	101 MMBF	98
SCHEDULED MAINTENANCE		
DAILY	.75 CLOCK HOURS/3 MANHOURS	OK
AT 1500 MILES	36 CLOCK HOURS/64 MANHOURS	24.4/37.9 *
UNSCHEDULED MAINTENANCE		
ORGANIZATIONAL 90 PERCENT	< 4 CLOCK HRS/8 MANHOURS	3.4/5.68*
DIRECT SUPPORT 90 PERCENT	< 12 CLOCK HRS/22 MANHOURS	4.7/8.13*
MAINTENANCE RATIO	1.25 MANHOUR/OPERATING HOUR	1.71 *
VEHICLE LIFE	6000 MILES	OK
POWERTRAIN DURABILITY	.5/4000 MILES	.21
PRIMARY WEAPON LIFE	1000 ROUNDS	OK
TRACK LIFE	2000 MILES	982
ROAD/IDLER WHEEL DURABILITY	<20 PERCENT IN 3000 MILES.	OK
SPROCKET LIFE	1500 MILES	1741

* DT DATA ONLY

SLIDE 4



Senator PROXMIRE. Thank you, General Ball, General Lawrence, and Colonel Aguanno for your excellent statements. I must say, you were reassuring and almost glowing to begin with, but toward the end, General Ball had a few caveats indicating there are still some problems that have to be worked out. But it's very reassuring if we can accept it all.

Our job, of course, here is to question this kind of thing as much as we can and try to get as much of the hard truth, however cruel and disappointing it may be, before us, provided it's the truth.

DEFECTS IN M-1'S PREDECESSOR AND ASSOCIATED COSTS

As you recall, we had some difficulties with M-60A2. In fact, the difficulties were of the dimensions of a disaster. The M-60A2 tank was sent to Europe and then had to be recalled. It's been a terrible disappointment at enormous cost with no results. So before we get into the latest M-1 test results, I'd like to ask about the M-60A2 which came up yesterday.

Can one of you tell us the facts about this tank—the number and time period in which it was sent to Europe, the nature of the problems with them, and the reasons the Army decided to recall them, and when that decision was made?

Colonel AGUANNO. Yes, sir. The M-60A2 is equipped with the 152-millimeter gun and a shillelagh. It was basically an interim weapon, fabricated and designed at a time when we were faced with tremendously overwhelming odds in tank ratios, with a missile capa-

bility aboard the tank, that would provide a much greater defensive range.

As we have progressed in our inventory, the M–60A2 has become less productive from the viewpoint of an effective combat weapon. So we are bringing it back. We've manufactured in the vicinity of 540 of them. We had 349 M–60A2's in Europe. They are being brought back at about $6,000 in transportation cost.

We have other uses now that would make it a much more productive piece of hardware for the Army. These other uses would include converting the M–60A2 chassis to a scissor-bridging capability—assets which are critically short now.

Senator PROXMIRE. Let me interrupt, Colonel, to ask you, when you presented this to Congress as a tank, did you present it then as an interim weapon that will be sent to Europe briefly and then called back here and would probably be used for other purposes?

Colonel AGUANNO. It was mentioned that when the tank ratios, scenario, and threat changed, the requirement for that type of weapon may very well change.

Senator PROXMIRE. Did you think that it would happen as soon as this, so that it was sent to Europe, served little if any purpose, and then was recalled with the possibility that it might be used for these other objectives that you talk about?

Colonel AGUANNO. Now that the evaluation has determined that the M–60A2 is not sufficiently productive to remain, we decided to look at what we should do with these assets to make the maximum use of taxpayer dollars.

Senator PROXMIRE. How much did the M–60A2 cost? When will the recall be completed? And how has the Army decided what to do with them?

Colonel AGUANNO. The average unit cost of the M–60A2 at the time it was procured is $761,000. As to its disposition the chassis—consisting of the hull, engine, transmission, et cetera—is being studied for other uses. Currently, the Army is evaluating several alternatives to determine the most cost and operationally effective solution. One solution which appears promising is to use these chassis to provide additional AVLB's. In fact, the Army has made a recent recommendation to Congress to fund conversion of 38 of these chassis to provide AVLB's for the National Guard.

Senator PROXMIRE. And the recall will be completed when?

Colonel AGUANNO. The recall should be completed next month, sir.

Senator PROXMIRE. Can you tell us what went wrong with the program and what the Army learned from it with their insufficient testing before the tanks were sent to Europe? Do you see any parallels or danger signals in the M–60A2 episode, as far as the M–1 is concerned?

Colonel AGUANNO. No, sir, we do not. Incidentally, our schedule was designed to accelerate the return of the M–60A2, to complete it within the year. We expect the final retrograde shipment of 56 tanks to arrive in Mobile, Ala., on August 11.

No, we do not see a parallel, sir. As a matter of fact, there is quite a difference. The M–1 tank is truly the answer to the current threat.

Senator PROXMIRE. What would be your answer to the charge that you blew $300 million on this?

Colonel AGUANNO. Well, sir, I would like to defend the Army by saying that is not an accurate statement.

Senator PROXMIRE. Why isn't it accurate?

Colonel AGUANNO. Hindsight provides some additional views that are certainly an asset in capturing the threat at that time. And as I state again, the overwhelming numbers of tanks that we were facing at that time, and to some degree are still facing, that the M-60A2 was visualized as one potential answer.

Beginning in 1980, we fielded a heavy antiarmor system called the improved tow vehicle [ITV]. The ITV has supplanted the long-range heavy antiarmor capability formerly provided by the M-60A2.

Senator PROXMIRE. Let me read you a statement and ask you if you agree or disagree. This is from the GAO report, dated July 1, and that was the basis for part of their testimony.

> The M-60-A-2 tank was deployed in Europe in 1974 with serious hardware design problems and inadequate logistic support capability, trained personnel, test equipment, spare parts, and technical manuals. The support costs have been high, and the system has never outgrown its reputation as an unsupportable tank.

What's your reaction to that?

Colonel AGUANNO. Well, in terms of reputation, that's correct. It has presented supportability problems from the outset. That's one of the reasons why we would like to withdraw it. In terms of the biggest bang for the buck, we can use our resources to better advantage elsewhere. The primary factor to be considered is the total support requirement for the M-60A2 versus other weapons with equal or better capabilities that are now being fielded.

Senator PROXMIRE. Then you see no parallel comparison with the M-1?

Colonel AGUANNO. Not in the sense of its effectiveness as a future weapon.

General LAWRENCE. I might add, Senator, I think the Army went to school on that system. It's partially from the lessons learned on that system that we developed our integrated logistic support concept, which, at the outset of development, assures those ancillary issues such as manuals, tools, test equipment, training, maintenance, and logistic support planning have been integrated into the development program for the hardware.

Senator PROXMIRE. Can you discuss how the M-60A2 did in its RAM-D tests? Did it achieve the Army's goal for reliability, maintainability, and durability?

Colonel AGUANNO. Sir, the numbers derived during those test years do not have an exact equivalent to the well-defined numbers for the RAM-D testing that we have now. It is unfortunate that the record does not provide truly comparable numbers. It would be difficult to extrapolate the current definitions into the test data which has long been lost during that period of time.

So, it would be difficult to answer your question as precisely as I know you would like. There were some deficiencies at that time. There's no question, and I think General Lawrence's statement brings that out, there are some things we learned and learned well.

Senator PROXMIRE. Could you supply the RAM-D data for the record—what you're talking about now?

Colonel AGUANNO. For the M-60A2, sir?

Senator PROXMIRE. For the M–60A2.

Colonel AGUANNO. We can, sir. But as I said, they do not follow the same definitions to be able to make a direct comparison with the M–1 RAM–D data that we have today. So it's a little bit like comparisons of apples and oranges, if you want to make that comparison. But yes, sir; we can supply it.

Senator PROXMIRE. With that warning, so we can be well aware of the degree to which we can compare them, because we cannot——

Colonel AGUANNO. Yes, sir.

[The information referred to follows:]

M–60 TANKS

The M60A2 ET/ST 71 contains some useful information pertaining to achieved RAM–D performance of the M60A2 as compared to the A1. There is no information that addresses mission reliability goals for either the M60 A1 or A2. The system reliability goal for the A2 was 110 mean miles between failures (MMBF). While the data do not respond directly to your questions, the information is relevant to the purposes of this hearing. A principal objective of the test was to assess the validity of assigning a system reliability of 101 MMBF to the M1 by comparing results obtained by the two M60 models. The data follow:

	Achieved performance (mean miles between failures)		
	M–60A1	M–60A2	M–1
Turret elect	3,083	1,286	NA
Hydraulic	5,760	1,098	NA
Fire control	2,383	1,572	NA
Model peculiar components	1,182	577	NA
Common components	139	136	NA
System reliability*	112	82	126

*These achieved reliability figures compare directly to the system reliability requirement of 101 mean miles between failures proposed for the M–1 tank. The M–1 achieved reliability is derived from latest M–1 DT/OT III test results.

Additional information taken from a 1974 Army Materiel Systems Analysis Agency (AMSAA) report on M60A2 test results show an achieved reliability figure comparable to mission reliability as computed for current usage. These test results for the M60A2 compare to the achieved M1 mission reliability of 350 MMBF.

M60A2:

Mission MMBF ET/ST	242
Mission MMBF IPT	222
Mission MMBF IPT retest	320
Mission MMBF confirmatory troop test	200

Senator PROXMIRE. Senator Jepsen.

Senator JEPSEN. Thank you, Senator Proxmire.

I stated yesterday during the questioning and taking into consideration the M–1 tank and its problems to make sure we're comparing apples with apples. I also stated at the same time and I want to repeat here today that those of us on the Armed Services Committee who have been wrestling with authorizations and so on for this program, are concerned. And I will be asking some questions that concern us in the M–1 program.

OPERATIONAL RELIABILITY OF M–1

The biggest one seems to be, in light of our discussions the other day in our committee, was how long will it last on the battlefield? And none of us on that committee, nor anyone that I know, wants

to in any way be a part of approving or putting our American fighting soldiers in a bank that will let them down when it gets on the battlefield.

So in light of that, is the Army's M–1 tank prone to break down and virtually impossible to repair in the field, as alleged by the GAO?

Furthermore, is it true that tank's logistical problems are so severe that it raises questions whether the tank can be operated in a realistic battlefield environment?

Can you respond to that?

General BALL. I think I should respond first to that, and possibly General Lawrence might have further comment based on his experience with the battalion in a simulated combat operation.

Our measure of combat reliability is defined just as that—the combat reliability. And we've measured that in testing to date to be in the operational environment. The test results indicate a 304 mean miles between failure of something that would degrade the operational or combat capability. We have a lower number in DT, developmental testing, when we combine the two numbers, which is the way we have written up the contract specifications, we come to a number of 278 mean miles between combat mission failure.

This is the as-tested data. The normal procedures are to go through an aggregation conference, as it is called, in which we assess the fixes. For example, I mentioned the transmission problem that we had. We're confident we fixed that. A conference is meeting now to assess if that fix corrects the problem and the follow-on test we did is adequate to give confidence that those kinds of failures aren't going to be repeated. We have full expectation of meeting that goal of 320 mean miles between combat mission reliability failures. That's the established target, that's sufficient to give us very high confidence that the tank will perform its combat mission without crippling failures.

Senator JEPSEN. By way of giving something that we can get a base of reference from, how would that compare with a similar application of measurement on the M–60?

Senator PROXMIRE. Can I just interrupt for a minute? There is a rollcall. I'm going to leave at once. Congressman Richmond is going to be able to stay. The rest of us will have to go at one time or another, so Congressman Richmond may preside, if the vice chairman of the full committee agrees.

So I'll leave right now. Go right ahead.

General BALL. Sir, in comparison with the M–60—and I am compelled to caveat with the recognition that the M–60 is a mature tank in production for more than 20 years—the established combat reliability factor, mission reliability, for the M–60 is about 400 miles.

Senator JEPSEN. All right. What are you saying, then? All I want for the record is, the 320 miles—is that the one you were referring to?

General BALL. Yes, sir.

Senator JEPSEN. Is that good? Is it better than the M–60 was when it was an infant 20 years ago? Is it satisfactory? Is that what you want? In other words, where are we on it?

General BALL. It's good, sir. That's what we established in 1972. And for reasons, as Colonel Aguanno mentioned, I can't relate that specifically to where the M–60 was in 1972, because we didn't have a parallel measure.

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Colonel AGUANNO. But I can state in general terms, in that case, considering we're still working with apples and oranges to some degree, it was between 130 to 160 at the same levels of maturity, and doing some extrapolation to try to make equivalent definitions of terms. It would bring you to a factor of about one-half the reliability of the M–1 now, sir.

Senator JEPSEN. OK. A major drawback highlighted by the GAO report is that the tank requires many more gasoline trucks, ammunition trucks, and other support vehicles than the current M–60 tank. The M–1 requires about 3 gallons of fuel to travel a mile, a range 30 to 90 percent more than the M–60's fuel need. The M–1 also carries eight fewer rounds for its turret cannon than the other tanks, which requires more ammunition trucks for the M–1. Deployment is also a problem in that the largest transport planes and railroad flatcars can only carry one M–1 tank as opposed to two M–60's.

Are all of these statements generally correct? And if they are, what does it mean?

General LAWRENCE. I'd like to respond to that from the standpoint of the testing that my troops have done at Fort Hood over the last 10 months.

As I pointed out earlier, in May we conducted a 96-hour field exercise which culminated the troop evaluation. This was a very stressful and arduous test, simulating combat scenarios in Europe against a representative opposing force. I believe it more than represents the kind of scenarios we would experience in a combat day in Europe.

As I pointed out in my statement, we carried into the field about 700 more gallons for the M–1 battalion task force than we normally carry for an M–60 task force. During the most stressful period of that exercise, we never had a fuel problem. We were able to fuel at night, fight all day, and not have to refuel until the next evening. This is the combat measure that we are concerned with tactically.

We achieved this with the M–60 as well. The M–1 does use more fuel; I dispute that it uses 90 percent more fuel. I would say probably in the 30- to 40-percent category might be far more accurate.

Senator JEPSEN. GAO said ranging from 30 to 90.

General LAWRENCE. I dispute the 90 percent. But you've got to remember that we are truly, Senator, comparing apples to oranges. The M–60 has a 750-horsepower engine. The M–1 has a 1,500-horsepower engine. It will take us places the M–60 cannot go, as I pointed out, with much greater agility and much higher speeds. We can achieve speeds of 20 miles an hour from a standing start in less than 7 seconds. It takes us 16 seconds to do that with an M–60. In combat, that dash capability, that agility, equates to survivability.

Senator JEPSEN. Senator Symms is not going to be able to return, so I'll yield to him.

Senator SYMMS. General, I just have one question. What's the troop route there in the field, say if the curtain came down tomorrow and you did mount out with the 1st Cavalry Division? Do the troopers all want to be in the company or battalion that have M–1's or do they want to be with the M–60's?

General LAWRENCE. Sir, I would answer an unequivocal yes, but I've brought with me two platoon sergeants—Sergeant First Class

Braggs, who is second in command of a platoon in Charlie Company, the first company to receive those tanks, and Sergeant First Class Maggard, who is a platoon sergeant in B Company, the second company to receive those tanks. Both men are familiar with the M–60, having operated with the M–60 series prior to joining the M–1 battalion. Both these men have been with the M–1 battalion for an extensive period of time, have four tanks under their control, and know it better than anybody. And I'd like to have those two gentlemen come up here and respond to your questions.

While they're doing so, I would like to respond to the issue on ammunition, if it pleases the subcommittee.

Senator SYMMS. Come on up, Sergeants.

General LAWRENCE. On the issue of ammunition, it's true that the M–1 carries only 55 rounds of ammunition, and the M–60 carries 63 rounds. They're both 105-millimeter guns. So in terms of cube and weight, we're actually carrying less ammunition for the M–1 battalion per tank than we're carrying for the M–60 in terms of cargo capacity.

I might point out, however, that the operational feature that I, as a commander, am concerned about is stowed kills; how many rounds representing kills are aboard that tank. I consider the fire control system of the M–1 to be so superior that the stowed kills aboard my M–1 tanks are greater than the stowed kills, if you will, aboard my M–60's by a considerable amount. That's the bottom line. That's the payoff in combat.

Senator SYMMS. Sergeant, do you feel like your chances for survivability would be better in the battlefield in the M–1?

Sergeant BRAGGS. Yes, sir.

Senator SYMMS. That's primarily the main reason? Or tell me a little bit about it as a tanker.

Sergeant BRAGGS. In my position as a tank commander in control of four tanks, the speed of the M–1, the sighting system, the design of it, all make it better than the M–60's. In other words, the silhouette of it, the material used, I just feel more confident that my troops will survive a war easier, better than in an M–60.

Senator SYMMS. Do you want to add anything to that, Sergeant Maggard.

Sergeant MAGGARD. Sir, I'd just like to agree with Sergeant Braggs and point out that the three primary capabilities of any armor are to move, shoot, and communicate. With that M–1 tank, we can do it with much greater ease and in a more efficient manner than any M–60 series tank that has ever been designed.

Senator SYMMS. That's pretty good testimony.

General LAWRENCE. I'd like to ask both to comment about the maintainability of the M–1 system. That's been one of the issues at hand—how the tank can be maintained compared to the M–60.

I said earlier that my troops believe, as I do, that it's easier to maintain the M–1 tank, but I think these gentlemen can be specific about some of that.

Senator JEPSEN. General, may I ask that they do respond, and when they do, please use the microphones, pass them one to the other, so that we make sure we get it in the record.

We both have about 3 minutes left to catch a vote. We're going to return.

What you're saying will be taken down and made a matter of record. That's the primary reason that you're here and we're all here today, is to make this record. Speak into the mike, and we will return.

Can you handle this Congressman?

Representative RICHMOND. Senator, I'll try.

Senator JEPSEN. I'll be back.

Representative RICHMOND [presiding]. Thank you, Senator.

You know I've been sitting here listening to the testimony and reading it, and I'm totally mindboggled. Here you have a tank which is 4½ times the cost of the M–60A2, $2.5 million a copy; right?

Colonel AGUANNO. Sir, may I address that point now? It is not 2½ times the price of an M–60.

Representative RICHMOND. The M–2 cost $600,000 per copy. Now what's the cost of the M–1?

Colonel AGUANNO. The M–1 is, I would say, in current dollars about $2.7 million for the M–1 at this point in time. That is unit hardware cost.

Representative RICHMOND. The General Accounting Office says $2.5 million.

Colonel AGUANNO. I said, sir, in current dollars.

Representative RICHMOND. The M–1 is going to cost $2.5 million per copy. I wouldn't mind spending the $2.5 million per copy for a superior tank. But what I see here, you know, my mind is totally boggled.

My field, as you may know, is domestic policy—human nutrition, social welfare programs. Over in the House now, we're in a budget reconciliation where every single dollar is being cut, cut, cut on every social welfare program in the United States.

Then I listen to you fellows telling me about a tank that's going to cost $2.5 million that will only run for 30 miles before it requires maintenance. Now how in the good Christ can you put that tank into a battle?

Sergeants, would you like to be in a tank that's going to collapse every 30 miles?

The General Accounting Office says that this tank that we're talking about, that everyone has spoken so glowingly about, will only run for 30 miles. Would you like to be in a tank that breaks down every 30 miles?

Sergeant BRAGGS. No, sir. But if you're talking about the M–1, I've rode the M–1 in a 4-day simulated war for a total of over 400 kilometers. My tank never did break down.

Representative RICHMOND. You must have had a very wonderful tank, because the General Accounting Office, which has, you know, 1,000 competent people studying the Pentagon, says it breaks down in 30 miles.

Colonel AGUANNO. Which is not really correct, sir. That's just the fact. What the breakdown was becomes part of the problem. For example, if, the windshield wipers on a new automobile suddenly quit running smoothly, they're working, but they're just chattering or something—you may consider that a failure, but you can continue to operate for weeks.

Representative RICHMOND. I'd hate like hell being under battle conditions and not have my windshield wipers working.

Colonel AGUANNO. I'm saying they're working, but they may not be working properly.

Representative RICHMOND. They're working and they're not working. Now come on.

Let's talk about your tank tracks. The average tank—I mean, these tank tracks have to be changed every 1,000 miles, right? That means the entire tank is totally useless, has to be returned to some base where it gets new tank tracks, because a tank, no matter how many million—you can spend 10 million bucks for a tank, but if those tank tracks aren't functioning, you can't use the tank; is that correct?

Colonel AGUANNO. It does not go back to the base.

General LAWRENCE. I'd like to speak to the tank track. We've had much better experience in the 1st Cavalry Division with tank track than has been advertised for this system. We changed out six sets of tank track in Charlie Company, C Company of that battalion, at an average distance traveled of about 1,200 miles. That's not much worse than we can get with the M–60. A tank track today is a problem with any tank in the world. Until we have a major technological breakthrough in materials or track design, no tank in the world is going to get 2,000 miles.

Representative RICHMOND. What about the Soviet tanks?

General LAWRENCE. The Soviet tanks have a different kind of a tract than ours. They have steel track rather than a rubber bonded track. Now we change our track in peacetime when the tr ad is gone or chunked out and the metal is exposed, primarily to save roads and things like that. But in combat, we could go for many, many more miles with the tread worn on that tank and still have an operational system. We wouldn't be changing it out every 1,000 miles. But for peacetime conditions and under the conditions where we travel on major roads in this country, we make sure that we've got an operational track for those roads, which means it's not chunked out to expose a great deal of metal which would damage the roads.

Representative RICHMOND. Under maneuver conditions, do you switch from rubber tracks to metal?

General LAWRENCE. We do not.

Representative RICHMOND. Do we have metal tracks in stock in Germany in all of our forward bases?

General LAWRENCE. To my knowledge, we do not.

Representative RICHMOND. Then how are we going to be ready for war?

General LAWRENCE. The track we have is perfectly adequate.

Representative RICHMOND. It has to be changed every 1,000 miles.

General LAWRENCE. That's not correct. We have not had to change this track every 1,000 miles.

Representative RICHMOND. General, you know we're blessed with a General Accounting Office which is awfully good. They say that your tank tracks—and I think the testimony here today was that your tank tracks need to be changed every 1,000 miles.

General LAWRENCE. I'm talking to the experience I have had in Fort Hood, Tex., sir. In my tank battalion with the M–1 tank, we have not had to change track after 1,000 miles. And after all, sir,

we should be comparing this with the M–60 tank; that's the tank that this will replace.

Representative RICHMOND. I want to compare it with the Russian tanks.

General LAWRENCE. It's a winner by every measure of operational performance.

Representative RICHMOND. Except that you're going to have these tanks in forward bases, and you're not planning to put metal tracks on them. And we know that the rubber tracks wear out in 1,000 miles.

Don't you think maybe we ought to have a supply of metal tracks out there, too?

General LAWRENCE. If the decision is made to put metal tracks in our inventories, that's fine.

Representative RICHMOND. You know, General, you've had such marvelous experience with this tank; yet the official computations from Fort Knox and Aberdeen have been anything but marvelous.

How come since you've had such wonderful experience—how come the Army hasn't used Fort Hood for its computations and analysis?

General LAWRENCE. As a matter of fact, sir, it has. We've had as you know, the GAO down there for 2 months. Their report has not been rendered at this point.

Representative RICHMOND. They have been at Fort Knox and Aberdeen.

General LAWRENCE. The report that they will render later on, I presume this month or next month, will cover the period of time they observed at Fort Hood, Tex. We've had our test and evaluation agency down there, which has been with us since last September, gathering data, conducting statistical examinations of that tank. And much of the data that I spoke to today, from the standpoint of logistics and maintenance supportability, comes out of that report as emerging results.

Now I cannot speak for Fort Knox, and I cannot speak for Aberdeen. But my soldiers and I can speak for Fort Hood and the very strenuous and stressful tests that we have conducted on that tank under simulated combat conditions which at least match the combat conditions we've had in Europe. And that tank has been an absolute winner by every measure of performance. And my soldiers will back me up on that.

Representative RICHMOND. You see, General Lawrence, you say all these wonderful things about the tank. Yet the General Accounting Office says the exact opposite. Fort Knox and Aberdeen proved the exact opposite. I can't see why Fort Hood is so far superior.

General LAWRENCE. I have to fight with that tank. I don't want to put a tank on the battlefield that my soldiers could not survive in.

Representative RICHMOND. General, how can you fight with a tank that requires maintenance every 30 miles?

General LAWRENCE. Sir, I have not experienced that. General Ball can speak to that, but I have not experienced that with my tanks, nor have my soldiers.

Representative RICHMOND. General, under optimum conditions. when should a tank require maintenance? How many miles should one be able to use a tank before it requires maintenance?

General BALL. Our target for this tank is that we be able to go 101 mean miles between system failures. System failure is defined as one which doesn't seriously degrade the combat function of the tank, but which should be repaired at the first opportunity. We are meeting that requirement. We have the "as tested" before any assessment is made; it indicates 98 combined score, but in an operational environment an average of 130 miles between system failures.

We have the other definition that I've been through for combat mission failure which says that before any assessment is made, we're averaging 278 miles of operation in an operational mode summary between failures of the system that would degrade the combat effectiveness.

I can't reconcile the 30 miles——

Representative RICHMOND. Degrade combat effectiveness? It seems to me, if one requires maintenance every 30 miles, you have to stop the tank for maintenance, and you're a sitting duck to anyone who wants to shoot you down, no?

General BALL. I cannot reconcile at all the statement that we have to stop every 30 miles to do maintenance. I haven't seen it. I can only assume that the total maintenance actions performed to include those done back in the motor pool on a scheduled basis were divided by the miles operated. I have not seen instances and I cannot reconcile that we stop the tank every 30 miles to do essential maintenance actions because of failure. And that's what's implied by the statement.

Representative RICHMOND. General, the General Accounting Office, in which we all have confidence—do you have confidence in the General Accounting Office?

General BALL. In certain areas, yes, sir.

Representative RICHMOND. In this case, you don't, then?

General BALL. I cannot reconcile that number.

[The following letter was subsequently supplied for the record:]

DEPARTMENT OF THE ARMY,
Warren, Mich., July 30, 1981.

DR. CHARLES H. BRADFORD,
Assistant Director, Joint Economic Committee,
Dirksen Senate Office Building,
Washington, D.C.

DEAR DR. BRADFORD: The inclosed statement is submitted in response to a statement contained in Mr. Sheley's testimony of 21 July 1981. Page 6 of his prepared statement contains a table prefaced by the statement that " * * * we tabulated the average number of miles the tanks traveled before they had to stop for unscheduled maintenance."

Those data are not factual as presented. The GAO representative who prepared these data (Mr. Beckeman) has acknowledged that all unscheduled maintenance actions, whether or not a stoppage was necessitated, were included.

I hope this information is helpful in clearing up this issue for the record. I appreciate the opportunity to respond.

Sincerely,

DURARD D. BALL,
Major General, USA, Program Manager.

Enclosure.

STATEMENT

The GAO Statement that the M-1 tank averaged only 30 miles between stoppages for unscheduled maintenance is not accurate. I have discussed this matter with the individuals who prepared and presented this testimony and verified that their data indicated that the average number of unscheduled main-

tenance actions was one every thirty miles; but, that this did not mean the crew had to stop an operation to perform the maintenance. Many unscheduled maintenance actions are minor and most can be, and are in fact, deferred and corrected at a routine halt or scheduled service. A more meaningful indicator of mission reliability is measured in testing as "combat mission reliability". This measure addresses the average number of miles the tank travels between failures which seriously degrade its ability to perform a combat mission—this number has been assessed at 350 mean miles between failure (MMBF) in our testing to date—considerably above our requirement of 320 MMBF.

Representative RICHMOND. They say:

The system reliability statistics developed by the Army were designed to assess the product delivered by the contractor in accordance with certain criteria adopted by the Army. These are not, however, fully indicative of the reliability to be anticipated on the battlefield. The Army statistics do not consider breakdowns or mishaps which it attributes to crew error during operation, maintenance errors, mishaps resulting from accidents, temporary quality control problems, and breakdowns that can be repaired within 30 minutes.

I'd like to know how you repair a tank in 30 minutes under battle conditions? How do you do it?

General BALL. There are many malfunctions that can be repaired in under 30 minutes. If you're directly engaged in fire it would be very difficult.

General LAWRENCE. We can remove and replace the transmission and engine on this tank in less than 30 minutes, as easy as it is to maintain.

Representative RICHMOND. Meanwhile, this tank is stopped and is a sitting duck for anybody.

General LAWRENCE. We don't fight that way, no.

Representative RICHMOND. What do you do?

General LAWRENCE. If we have a malfunction on the battlefield, we'll move to a place where we can repair the tank where it's not under fire.

Representative RICHMOND. If the tank is stuck, it would be pretty hard to move it, wouldn't it?

General LAWRENCE. That's correct. But the kinds of malfunctions that would cause a tank to stop completely don't occur every 30 miles. We have not experienced that.

Representative RICHMOND. You know, I get the feeling that sure, this M–1 tank might be great but that it needs an awful lot of design improvement before you start mass-producing it.

Now, according to the colonel here, you're busy mass-producing this thing in Lima, Ohio, right?

Colonel AGUANNO. We are producing them, yes, sir.

Representative RICHMOND. Don't you think perhaps before you went into a production model, we could have cut out some of these bugs? I hate the idea of thinking that our fighting men are going to have to be in tanks that can get stuck every 30 miles.

Colonel AGUANNO. Sir, again, once again, the tank does not get stuck every 30 miles.

Representative RICHMOND. Why does the General Accounting Office say that it does?

Colonel AGUANNO. Sir, we cannot ascertain the rationale behind that number. As far as our statistics and our analysis is concerned, that is not a correct determination. If they can show us the basis

for that comment and show us we were wrong, we will be eager to address their comment. But right now, as far as we know, that is not correct.

General LAWRENCE. I think the men who ought to speak to this tank are the men who use it. And why don't you ask again the two tank platoon sergeants that I've brought here about maintenance on this vehicle and about its operational performance.

Representative RICHMOND. Sergeants, even the generals admit that the power train of this tank is not really perfected. Now if the the power train goes out under battle conditions, the tank is stuck; isn't it?

Sergeant MAGGARD. Sir, all I can tell you is that I have under my control four M–1 Abrams tanks. On each of those four tanks, I have accumulated in excess of 700 miles in the last 6 months.

Representative RICHMOND. On each tank?

Sergeant MAGGARD. On each tank, sir. In that timeframe I have experienced one power train failure, which was due to a $26 filter that was located at the transmission. Now it did take 12 days to repair. And that was initially because we didn't know what we were looking for when it happened.

Once this has been identified, that same failure takes less than 45 minutes to repair and can be done by a unit mechanic.

Representative RICHMOND. However, you have to have the parts. The tank is immobilized. Do you carry spare parts to replace your power train under battle conditions?

Sergeant MAGGARD. No, Congressman.

Representative RICHMOND. Where do you get the spare parts, then?

Sergeant MAGGARD. From our unit maintenance. The majority of the time, the filter doesn't even need to be replaced; it just needs to be cleaned.

Representative RICHMOND. There, again, the General Accounting Office feels that the tank is a sitting duck, because the power train hasn't been perfected. I'm only going on the material that I read, prepared by the General Accounting Office.

Colonel AGUANNO. No, sir, the power train is not perfect; that's correct.

Representative RICHMOND. If the power train is not perfect, why not perfect the power train before you go into production? Can you tell me that?

Colonel AGUANNO. Sir, what is the definition of a perfect power train?

Representative RICHMOND. A power train that doesn't keep breaking down.

Colonel AGUANNO. When we set targets for design, we set those targets well in advance of actually seeing, developing, and fielding hardware. As long as the weapon system meets the threat and is operationally reasonable to field, falure to meet each and every facet of the intended performance criteria, does not mean that it is not effective enough to field.

That is the point we're making. Yes, we set certain goals for ourselves, like 4,000 miles before we have to replace a power train component with a 50-percent confidence rate.

Representative RICHMOND. That would be 2,000 miles, but you've only got a 25 percent——

Colonel AGUANNO. No, sir. That's not the way that number reads; 4,000 miles for the 50-percent confidence rate.

Representative RICHMOND. And your tracks go for 1,000 miles, which means you're 25 percent of optimum.

General BALL. Sir, may I address something that will put it in perspective. In RAM–D-scored vehicles, the seven vehicles from which we're gathering the official data for reliability, availability, maintainability, and durability, we have had power train failures that require the replacement of a power train component at an average rate of one every 2,500 miles. This is before we make an assessment of the value of corrective actions that we've made to the design defect we found in the clutches and transmission.

And also, it includes some very early-on failures. In the first month of testing, we had four engine failures which have been attributed to deficient quality control and engine production. In engines produced since then—we tightened up that quality control last October—we have accrued 35,000 miles without a field engine failure.

But even the raw data that we're dealing with now, so far as loss of mobility or power train failure, equates to one failure every 2,500 miles.

In terms of track retention, we have averaged one thrown track every 15,000 miles, so that the track is primarily an operation and support cost. It is expensive.

We are most emphatically concerned with improving the durability of the track, but we see it as primarily an operation and support cost—an opportunity for operation and support cost savings if we can do it—because we do not view the track durability as a serious impediment to combat effectiveness; 1,000 miles is a long way in combat.

Representative RICHMOND. 1,000 miles is a long way in combat? In the type of war that we can expect with the Soviet Union, 1,000 miles is a long way?

General BALL. Yes, sir.

Representative RICHMOND. And what do you do with that tank after you've gone 1,000 miles and it runs out of tracks? The tank is totally useless; right?

General BALL. It doesn't go from good to bad precipitously.

Representative RICHMOND. Oh, yes, they do.

General LAWRENCE. No, they don't.

Representative RICHMOND. Once your tracks start breaking, they go from good to bad.

General BALL. Once it breaks.

But we take advantage of maintenance opportunities within that 1,000 miles, or when we judge the track needs replacing. It takes about 4 hours to replace the track, sir.

Representative RICHMOND. It's seldom that I've heard such totally disparate testimony. Yesterday the General Accounting Office informed us that, during operational testing at Fort Knox, the four test vehicles were often down for as much as 20 days at a time.

Now, during—as far as you know, how many of those tanks are down at Fort Knox for more than 24 hours at a time? Let's forget the 24 days. Let's say 24 hours.

General BALL. I don't have that information with me. I can supply it for you.

[The information referred to follows:]

M–1 TANK

During the 14,026 miles of operational tests conducted at Fort Knox on four tanks during the period September 1980 through May 1981, nine incidents occurred which required more than 24 hours of corrective maintenance.

Representative RICHMOND. I want to defend America as much as you do, but we're spending now $1.6 billion on a tank which is under production in Lima, Ohio, which is overmechanized, overloaded with an awful lot of equipment that no one knows how to handle, which by and large has gotten terrible grades from the General Accounting Office.

And we, Members of Congress, the only people that we have that can supervise you, if anybody in the world can supervise you, is the General Accounting Office. And if they say your tank breaks down, they say your tank isn't properly developed, they say your tank is overequipped, they say that there's no way that we have the people who can possibly maintain that tank.

Colonel AGUANNO. They also say to field it, sir.

Representative RICHMOND. $1.6 billion for producing the tank, when it seems to me the tank really ought to be further refined, further improved before we start producing it. You're going to have another situation like you had with the other tank, where you had to recall 500 tanks from Europe. And that was only a $300 million boondoggle. This is a $1.6 billion boondoggle.

General LAWRENCE. Respectfully, sir, I'd like to dispute your comment that people don't know how to use it. This has been used in the field for 10 months under operational conditions by soldiers wearing green suits who were trained on it, soldiers who had previously been using the M–60 tank and have a perfect basis for comparison.

I can tell you—and the testimony of the two sergeants here will support that—that given the choice, I'm not aware of a soldier in that battalion that would want to fight with an M–60 when they could have an M–1.

Representative RICHMOND. General, are we to say that the General Accounting Office is totally irrational and inefficient?

General LAWRENCE. I'm not saying that they're irrational.

Representative RICHMOND. And that this study is totally wrong?

General LAWRENCE. I'm not saying they're totally wrong. I'm not saying that they're totally irrational. But I'm saying that on the basis of the statements they've made concerning the operational supportability of that system and fightability of that system, they haven't got the facts from Fort Hood, Tex.

Representative RICHMOND. General, by the way, Richard Kaufman has advised me that the 1.6 is only for this year, that the eventual cost of this undeveloped tank, which has gotten totally bad grades by the General Accounting Office, will be $19 billion.

Now, look——

General LAWRENCE. Why must we hold the General Accounting Office, sir——

Representative RICHMOND. General, I'm a businessman. One of my companies makes heavy plastic equipment. We buy our machinery from Cincinnati Milacron, the finest machine tool company in the United States. They design a new machine, they bring it into our plant, and then we test it. And we test it, we test it, and we test it, until we're positively sure that the machine is operating properly. Then we perhaps ought to order 5 or 10 of them, but it seems to me to be in production, spending $19 billion of the taxpayers' money on a tank that isn't yet perfected is total insanity.

General LAWRENCE. Why is it that we hold up the General Accounting Office as experts in tank warfare or in tank operation?

Representative RICHMOND. Who else are we going to believe, General?

General LAWRENCE. Do you believe me, sir? Do you believe these soldiers?

Who else should you believe, except men who have operated with this tank under very stressful conditions for 10 months?

Representative RICHMOND. The only one I can believe is the General Accounting Office, which is an official arm of Congress which spends a great deal of time. And they're totally competent people.

General LAWRENCE. Who, to my knowledge, have very little experience in tank warfare or tank operations. They came down to see me and asked specifically to get in the tank to drive it and operate with it so they could understand something about it.

Representative RICHMOND. Then, are you saying the General Accounting Office report is totally incorrect, General?

General LAWRENCE. I'm not saying that, sir.

Representative RICHMOND. You just did.

General LAWRENCE. I'm not saying that.

Colonel AGUANNO. They did recommend going into production, sir.

Representative RICHMOND. The General Accounting Office recommended going into production?

Colonel AGUANNO. In the testimony yesterday, they did recommend proceeding. So, in spite of the fact that they have criticisms to make, they did come to the basic conclusion that we have come to.

Representative RICHMOND. I also understand that they warned against increasing the production rate.

It seems to me before we spend $19 billion of the taxpayers' money, we could improve the tank somewhat.

General LAWRENCE. Do you recommend, sir, that we buy the M–60 at current rates, a tank that is not as good as this tank?

Representative RICHMOND. No; I recommend that we have a crash program.

General LAWRENCE. It's ongoing, as the project manager described to you.

General BALL. May I address two points that I think are pertinent in perspective. The test at Fort Knox ran for 9 months, 14,000 miles on four tanks. We averaged 388 miles per tank, per month, on an

annualized basis that's equivalent to running those tanks 4,700 miles per year.

So we had the failures experience that you would normally expect to see in fielding units in Europe in 5 years. We saw them in 9 months. So that we had the total maintenance, the total waiting-for-parts time, the total administrative downtime that would be equivalent to 5 years in normal deployment in Europe. We saw that concentrated within 9 months.

So I think the downtimes give a greatly skewed representation what the availability rate of a system would be in normal deployment.

COSTS

Sir, as a businessman, you could not offer on a contract today for delivery in 1988 at today's prices. When we address the costs, the original design to unit hardware threshold cost of the Abrams tank in 1972 dollars was $507,790.

As we look to our current cost estimate, deescalated for inflation, back to 1972 dollars, it's $530,500. That represents about a 4½-percent net increase across the life of the program.

Included within that, we've changed the program structure. And we have, starting in 1984, the addition of a 120-millimeter gun, which adds about $25,000—fiscal year 1972 dollars—cost per tank. So that the cost of the system must be compared in the real-year dollars. The M–60A3 tank today, in the 1982 cost, is about $1.2 million per copy. A comparable cost, in the first year of production, high upon the learning curve, for the M–1 is about $1.7 million—higher, but not higher by the degree that is implied when we compare the total programs costs, stretched out through 1988.

Representative RICHMOND. General, my time is up.

All I can say is that, as a businessman, as an American wanting really to build up our Armed Forces efficiently and properly and safely, it seems to me that this tank ought to go back on the drawing board before we spend $19 billion of the taxpayers' money. And if it takes a couple of extra months, perhaps we're better off that way than having a tank that still isn't perfected.

I mean, the idea of mass producing a tank that still has bugs in it, and we know what the bugs are, boggles my mind. Perhaps I have to learn about defense. Thank you.

Senator Proxmire.

Senator PROXMIRE [presiding]. Thank you very much, Congressman Richmond.

Colonel Aguanno's testimony refers to unit hardware costs, which is only a portion of total program unit costs.

INFLATION COSTS

I want to follow up on what Congressman Richmond was pursuing earlier; the inflation costs.

Do you know that?

Colonel AGUANNO. Not offhand, sir.

Senator PROXMIRE. I'd be astonished if it were more than 100 percent. And this is 160 percent, since 1974. I don't know anything that's gone up that fast.

Colonel AGUANNO. We can prove our statement that 93 percent of that increase was caused by either inflation or increase in numbers of vehicles.

Senator PROXMIRE. Well, you don't have the documentation to prove it. And I concede the increase in the number of vehicles.

I am talking about the unit increase. I am not talking about the program cost—$900,000 and $2.5 million—I challenge that that was 93 percent inflation. But you don't have the documentation here, so we'll just have to examine it when you provide it and make our own conclusion based on that.

[The following information was subsequently supplied for the record:]

M–1 TANK

The table below documents the 93 percent figure:

[In millions of dollars]

	Procurement, fiscal year 1972 dollars	Escalation	Total
March 1974 estimate	1,937.2	983.5	2,920.7
March 1981 estimate	4,500.1	13,098.5	17,598.6
Estimate change, 1974–81	2,562.9	12,115.0	14,677.9

Note: $1,578.3 due to production quantity increase. Cost increases attributable to either escalation or production quantity increase is $13,693.3 ($1,578.3 plus $12,115.0). This is 93 percent of the total increase ($14,677.9) in planning estimates.

Senator PROXMIRE. What price index does the Army use in adjusting the $900,000 unit cost figure to 1981 dollars? What proportion of the cost overrun do you attribute to production delays, design deficiencies, and other shortcomings on the part of the contractor?

You've already answered part of that. You've indicated that you attribute 93 percent to what you call inflation. But do you have any cost figures for production delays?

Colonel AGUANNO. Yes, sir, General Ball has some details on that.

General BALL. Sir, if I could take a minute and trace back to 1972 and the large step-up. We have progressively estimated the program cost since 1972, the inception based on OSD indexes——

Senator PROXMIRE. May I just interrupt, to say the figure I gave was—the M–1 was $3 billion for 3,323 tanks in 1974, not 1972.

General BALL. Yes, sir. And I did not have the indexes with me to bring it from 1974.

But going to the base, the design unit hardware cost threshold was established in 1972 dollars at $507,790. We initiated the first 2 years of contracts under a ceiling price arrangement, in which the contractor negotiated to produce 110 in the first year, 352 in the second year, at ceiling prices, with an escalation clause and the escalation clauses eased on BLS indexes and UAW wage rates.

When we saw in those that the escalation permitted under the contract was substantially greater than we had estimated in the budget, we went back and reviewed our entire program baseline cost estimate.

We found that there was a substantial differential between the factors we had used to bring it up to 1982; the real world inflation.

We found that, based on the factors that we had experienced in the commodities we were dealing with——

Senator PROXMIRE. Let me interrupt, General, to say that as I understand it, Colonel Aguanno referred this to you to answer me on how much of this was attributable to production delays, design deficiencies, and other shortcomings on the part of the contractor. The answer to that question?

General BALL. No, sir. In specifics, I cannot. I came to the inflation, and the inflation from 1972 to 1981 is 3.1.

Senator PROXMIRE. You're the program manager. I should think you could answer that question.

General BALL I don't have the information with me today.

Colonel AGUANNO. Sir, let me try it again. The $900,000 and the $2.5 million are two numbers that do not have the same meaning. They do have significance, however.

If you want to take the $900,000 figure and compare it to an appropriate figure today, the current hardware purchase price of an M–1 is $1.7 million.

Now, the program unit cost——

Senator PROXMIRE. Before you go ahead, let me just say the GAO told us yesterday that those figures did have the same meaning and that they were comparable, the $900,000 and $2½ million.

Colonel AGUANNO. Yes, sir. But the $2½ million—what that price refers to is the programing costs per unit, as extrapolated out over the 7,058 tanks in those then-year dollars, the $900,000 was not that figure.

Senator PROXMIRE. Again, there's a difference between your position and GAO's.

Colonel AGUANNO. Yes, sir, as to the definition of those dollars; that's correct.

Senator PROXMIRE. Do program costs include the ammunition and the costs of replacing the 105-millimeter gun with the 120-millimeter gun?

Colonel AGUANNO. The delta costs between one round and another, sir?

IMPROVEMENT COSTS, AMMUNITION COSTS, AND TRAINING COSTS

Senator PROXMIRE. My question is: Do the program costs include the ammunition and the cost of replacing the 105-millimeter with 120-millimeter?

Colonel AGUANNO. The $2.5 million cost includes the 120-millimeter enhancement to the tank; yes, sir. Since ammunition is not costed against, it does not include the ammunition. Of course, the ammunition is an expended item.

Senator PROXMIRE. What's your estimate for the ammunition?

Colonel AGUANNO. That would depend on the estimated expenditure rate, sir. If you're talking about a per-round cost, I'd like to provide that for the record.

[The information referred to follows:]

120-MM GUN

Current estimates for per-round cost of 120-mm ammunition vary from between $780–$930 per-round for service rounds to be used in combat and between $298–$423 per-round for training ammunition. The magnitude of variance is dependent upon ammunition expenditure rates and quantities of ammunition to be produced.

Senator PROXMIRE. How much do you expect to spend on ammunition in this program?

Colonel AGUANNO. General Ball, do you have that?

General BALL. I do not have the ammunition expenditure costs.

Senator PROXMIRE. You do plan to buy ammunition, do you not?

Colonel AGUANNO. Yes, sir, we do. And we have some research and development costs that we are encountering right now. We have not finalized the development of the 120-millimeter rounds. Any production costs that we would provide to you at this time would be an estimated guess.

Senator PROXMIRE. I would think you could give us an estimate as of this time on what your ammunition is going to cost. The tank isn't going to be very useful except as a pleasure vehicle unless you can have ammunition for it and do something with it, so that ought to be part of the cost—that you'd have an estimate at least at this point.

Colonel AGUANNO. Yes, sir. I do have that. I did not bring it with me. I will provide it for the record.

[The information referred to follows:]

120-MM GUN

The current estimate for 120mm ammunition procurement cost, through fiscal year 1987, is $1.02 billion. This includes training ammunition to support operational testing of the M-1E1 tank and crew training in units which will be equipped with the M-1E1 and initial war reserve ammunition stockage.

General BALL. The training ammunition cost per vehicle per year is about $63,700 in constant 1982 dollars.

Senator PROXMIRE. I presume you would have an ammunition estimate as to how much should be available to have this as a ready part of your force in Europe when it's there, so that you have ammunition stored and ready to use in the event you had to go to war; isn't that right.

General LAWRENCE. Sir, we have that ammunition there because this tank uses the same tank ammunition as the M-60. We're changing out M-60's for M-1's in Europe, so the war reserve stocks on hand in Europe will satisfy the needs of both the M-60 and the M-1 at this time.

Senator PROXMIRE. Why is the Army waiting until after 2,000 or so M-1's are built before putting on the 120-millimeter gun. Won't it cost more to retrofit the earlier M-1's with the new gun, and why isn't the 120-millimeter gun being purchased in West Germany, which already has it on their tank?

General BALL. All right, sir. The first question of why are we waiting until after we have built more or 2,000 105-version tanks, there are several reasons for that. The paramount reason is the time it takes to make the technology transfer of the German technology into U.S. manufacturing methods. The approach selected by the U.S. Army was that we would purchase the design rights from the Germans and then learn how to manufacture the entire system, the 120-millimeter gun and breech system and the key ammunition rounds that go with it, exactly as the Germans manufacture those components, so that we will have interoperability with the Germans.

Senator PROXMIRE. Have you considered the option of buying this from the West Germans?

General BALL. I'm not cognizant of all the debates that went on on the decision. Insofar as I know, the decision was made in 1978 that we would manufacture the gun and the ammunition in the United States.

Senator PROXMIRE. As I understand it, the Germans have had this on their tank for years, so it shouldn't take us very long to establish this technology. It's an established technology in NATO.

General BALL. They integrated the 120-millimeter gun into the Leopard II tank, which is about the same production maturity as the M–1. But we still have transfer of German technology; technology transfer does take time. The establishment of the production capability takes time. We have some uncertainties in the combustible cartridge case round, and the Germans have some problem areas that they're working on in that.

We want to see with absolute confidence that the system does perform to our requirements. There are some bugs to be worked out both in the United States and Germany.

Senator PROXMIRE. Do the program costs include the approximately $800 million for the block improvements and other improvements and modifications planned for the M–1?

General BALL. No, sir, they do not. That figure was an estimate. We are doing an analysis of the operational effectiveness of the product improvements under consideration, and there is no Army decision as of yet as to what product improvements will be incorporated.

Senator PROXMIRE. If you include the block improvements at $800 million, then the program would go up to $20 billion from $19 roughly?

General BALL. Sir, in very round numbers, the total program, yes. We're now at a little over $18 billion for the total program cost, including R.D.T. & E. And that would increase it by $700 million from the current estimates.

Senator PROXMIRE. Is the Army planning to strengthen the armor because it turned out to be faulty in tests?

General BALL. No, sir, that is not correct. The plan that we have for improving the armor is to take advantage of improved technology and increase our survivability against threats that we project the Soviets have the capabilty to throw at us in the future.

The armor in the tank has more than measured up to all the requirements established.

Senator PROXMIRE. How likely is it that costs will increase further and reach or exceed $3 million a copy?

General BALL. In terms of production cost, I think that's unlikely, Senator. If inflation drives us there, it's quite possible. Inflation does very impressive things to the cost line when we take it out over several years.

SUPPORT COSTS

Senator PROXMIRE. What's your estimate of the total support costs for the M-1 over the total expected life of the tank.

General BALL. For a 20-year life cycle, we estimated $27 billion for the fleet.

Senator PROXMIRE. How much again?

General BALL. It's $27 billion in operation and support cost for 20 years for the operational fleet.

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Senator PROXMIRE. That does not include acquisition costs.

General BALL. No, sir.

Senator PROXMIRE. So you'd add $27 and $20 and get $47 billion overall; is that a fair statement?

General BALL. Yes, sir.

Senator PROXMIRE. Let me return for just a second to my previous question when I asked if the costs would increase further beyond $3 million. You're response was, "That depends on inflation."

What is your inflation estimate? Do you expect it to moderate, expect it to be the same pace in the next 3 or 4 years that it's been over the last couple of years?

General BALL. Sir, in building up, we've brought it up—well, in the outyears, we have applied the inflation indexes that are prescribed which start off—I believe it's about 51 percent extending into the outyears to about 5 percent.

Senator PROXMIRE. Five percent?

General BALL. Yes, sir.

Senator PROXMIRE. That's pretty optimistic. You indicated a terrific rate of inflation in 1974 and 1981 in answer to my previous question.

My question was, "How much of an increase will you have per unit if you have a continued rate of inflation of the kind we've had since 1974?" Would it be much more than $3 million a unit?

General BALL. Sir, I have not made that computation. I would have to assume some rate of inflation. If I assumed the same rate as between 1974 and 1981, it would be substantially greater than the 2.5 we now project, because we'll be building substantial numbers of tanks in the outyears.

Senator PROXMIRE. Does the Army make support cost estimates for all its major weapon systems?

General BALL. To my knowledge, yes, they do.

Senator PROXMIRE. Your answer was "Yes," correct? The services do estimate procurement costs, and Congress gets quarterly reports allowing us to see the status of major acquisitions.

Doesn't the M–1 case illustrate how important it is to always keep track of support costs?

General BALL. Sir, I fully support that. The support costs—the operations and support costs of maintaining the systems—are greater in most cases than the acquisition cost.

Senator PROXMIRE. But isn't it true that the present Congress does not receive from the Pentagon a breakdown of support costs for major weapons? And if the support costs double or triple during procurement because of poor planning or mismanagement, Congress is just ignorant of the facts.

General BALL. I don't know that I can respond to that. I'm not aware of specific reports.

Colonel AGUANNO. There are various reports that would give indications. To say that there's a detailed report that specifically talks by system over the years, expected support costs for each system, no, sir, that is not provided to Congress.

Senator PROXMIRE. Why don't we get that? If you make the estimates, why shouldn't we get that? You just indicated that support costs are going to exceed acquisition costs. It can be a colossal burden.

After all, this tank, which is a very, very important part of our defense but is also immensely expensive—$47 billion, most of it support costs—why shouldn't we know that in advance?

Colonel AGUANNO. We provide that on systems as required, willingly and avidly, to clarify the point to Congress, at all times.

Senator PROXMIRE. My question was, "Do we get it for all major systems?" The answer was "No, we do not." We get it, you say, where the Army may think it's important or sporadically. But we don't get it systematically. Why don't we get it comprehensively on every single weapon system? Wouldn't that be a good policy?

Colonel AGUANNO. I'm sure that it would be a basis for a better analysis by Congress, sir. I represent certain systems. Most of the early systems do come within our directorate. Those are large systems.

M–1 RAM–D TEST RESULTS

Senator PROXMIRE. General Ball's testimony discussed power train durability and other aspects related to reliability, referred to as the RAM-D parameters. You conclude, General Ball, that we are doing very well overall.

Now I question that. So let's look at your chart and compare it with similar data provided by GAO.

You concede that you're not doing very well in the area of power train durability; is that correct?

General BALL. Yes, sir. The data to date.

Senator PROXMIRE. You concede that you're not as of what, sir?

General BALL. In the testing to date, we have not demonstrated that we have met the requirement established, and I do not expect to meet that requirement by the end of testing.

Senator PROXMIRE. Then the information provided by the General Accounting Office shows that the power train durability results would look even worse if all failures of power train components were included in the score. For example, we're informed that during the recent tests, there were 53 incidents where engines, transmission, and power drives failed and had to be replaced but were not counted in the durability scores. I am also informed that many more such instances occurred than in the 1979 test.

How do you explain that?

General BALL. Sir, the requirements are established to be demonstrated under prescribed mission profiles. This is contractually established with the contractor. In this contract, we have with Chrysler, and the subcontractors have, what is called a correction of deficiencies clause in the contract. That is, Chrysler, as the systems integrator, signed on to build a tank that would meet these key performance specifications. We prescribed also the test structure under which we would determine whether or not they had met those performance specifications, which is the same methodology as determining whether or not we've met the material need requirements.

The tanks that are dedicated to that task are the seven tanks in developmental-operational testing, dedicated to RAM–D testing. Those are the failures that are scored in arriving at the official number for reliability and durability of the system.

Senator PROXMIRE. But these were failures. These 53 failures they talked about were so bad that they had to be replaced. Yet they were not counted. Why weren't they counted?

General BALL. Not in RAM–D tanks.

Senator PROXMIRE. Why not? Why shouldn't they?

General BALL. We didn't have that number of failures of engines and transmissions in RAM–D tanks.

Senator PROXMIRE. So the GAO facts are wrong?

General BALL. If they attribute that number to the seven RAM–D tanks, yes, sir.

Senator PROXMIRE. It only says, "We were informed during the recent tests there were 53 incidents where engines, transmissions, and power drives failed and had to be replaced but were not counted in the durability tests."

General BALL. Yes, sir. The durability test scores failures on only seven vehicles that are specifically designated and run under a specific profile.

Senator PROXMIRE. So the other failures were not counted.

General BALL. Yes, sir. Those are failures such as Fort Hood or anywhere else we had a failure.

Senator PROXMIRE. Do you know or can you provide information for the record on the power train durability of the M–60A1, A2, and A3 versions during the operational and development tests?

General BALL. Sir. There was no requirement to determine that type of RAM–D data for the M–60A1, and M–60A2 or for previous tanks. This is the first tank for which we've had a specific power train durability requirement. So we don't have the data.

Senator PROXMIRE. You don't have the data on the power train durability for the M–60A1, M–60A2, and so forth?

General BALL. No, sir, not in comparable testing.

Senator PROXMIRE. Now you concede the maintenance goal is not being achieved and that part of the reason concerns the shortfall in the test sets manual and training. According to GAO, the Fort Knox tests showed 2.86 man-hours of maintenance for every hour of operation.

How do you reconcile your figures of 1.71 man-hours to the GAO's figures? You have about half as much.

General BALL. Yes, sir. The figures I quote are the figures generated at Aberdeen during the development tests, which are the only ones that we have that the scoring test community has validated data to this point. That data is supposed to represent actual required time. Other time that's not directly applied to maintenance and operations, diagnostic testing and repair is excluded.

Senator PROXMIRE. My point is, you're talking about Aberdeen. Why did you exclude Fort Knox? It's obvious up there that the Fort Knox figures are much worse?

General BALL. I think they will be worse. But there is still discussion and analysis of those figures ongoing within the test community among the people who analyze and put the final numbers on the scoring of that data.

Senator PROXMIRE. According to the General Accounting Office the recent Aberdeen tests show continued disappointing results for reliability. They show 75 miles between failures versus the 101-mile goal for the system reliability and 251 miles between failures for combat mission reliability against a goal of 320 miles.

How do you reconcile GAO's figures with your own?

General BALL. Sir, I don't quarrel with those figures. Those are the figures from Aberdeen. There is an anomaly between the figures at Aberdeen and the figures at Fort Knox. The comparable figure to the 75 at Aberdeen is 130 in the RAM–D testing at Fort Knox.

Senator PROXMIRE. Now the GAO testified that the inherent availability of the M–1 was 54 percent at Fort Knox. GAO's July 1 report stated that there originally was a requirement that the M–1 achieve 89 to 92 percent inherent availability, but the Army dropped the requirement.

Why was the requirement dropped?

General BALL. Sir, I don't know why the requirement was dropped, and I don't take issue with the numbers. But the numbers need to be applied against some understanding of what the implications of inherent availability are in terms of true operational availability in the field.

Senator PROXMIRE. According to the GAO report, this characteristic I just described measures the probability that a system will operate satisfactorily when you need to operate it.

Shouldn't this criterion be a key factor in evaluation equipment readiness? Was the requirement dropped because you knew it could not be met?

General BALL. That, I would defer possibly to the tester for any information. I have no information on that.

Senator PROXMIRE. Fine. General.

General KIRWAN. I have no information on when that criterion was dropped. No, sir.

Senator PROXMIRE. It seems to me that it's a very useful criterion. I'd certainly want to know that in my automobile, for instance—whether it's going to be ready when I need it.

General KIRWAN. When we present to the Army decisionmakers the results of the operational tests, we will include for consideration those figures of availability. Even though there are no stated material need requirements, availability rates will be presented to the decisionmaker, so he will have that.

Senator PROXMIRE. All right. We'd appreciate that.

General Lawrence, in testimony before the House Armed Services Committee on March 31, 1981, General Wagner, the commanding general at Fort Knox, reported that operational availability during Fort Knox testing was 42 percent.

How does that compare with the operational availability at Fort Hood?

General LAWRENCE. Sir, during the entire period of testing, we have kept count of the operational readiness of that battalion, based on the cumulative available days for the tanks, divided by the possible operational days for the tanks—that is, the days that they have been in the unit. We've maintained, during the period of testing and evaluation over 80 percent.

Senator PROXMIRE. Over what percent?

General LAWRENCE. Over 80 percent. Last week, I received a report, as I do weekly, on the system, and the operational readiness is calculated by available days divided by possible days as almost 89 percent.

Senator PROXMIRE. Here, we have just an absolute contradiction of the testimony by Walton Sheley.

Let me just say this. He said operational availability at Fort Knox, 49.9; Fort Hood, 48.2—not 80 percent, 48.2.

General, go ahead.

General KIRWAN. Let me put that in the proper perspective. We're talking about two different things here.

The Army has a readiness reporting system which is called its operational reporting system. Those are the figures that General Lawrence is reporting. We, the testers, use a different computation to come up with operational availability in that we account for every minute of that tank, of the fleet of tanks that's being tested, throughout the testing period.

If the tank goes down for 5 minutes, we capture that information, and it becomes a part of our equation. General Lawrence uses the Army's operational readiness reporting to get his 80 percent. And there is a distinct difference between the two. We're talking apples, and he is talking oranges.

Senator PROXMIRE. If the tank is unavailable 48 percent of the time; is that a correct interpretation?

General KIRWAN. What we're trying to show in the test by capturing this data is that at any random point in time, this is the number of tanks you could expect to have operational.

Senator PROXMIRE. When you say "this," you're referring to the 80 percent figure?

General KIRWAN. No; I'm referring to our availability figure. At any random point in time, this is what you could expect to have operational. That's based on the fact that you're tracking that tank for every minute of its existence during the test.

Where we get into difficulty in trying to judge what that really means is that availability is a function not only of the reliability of the tank, the durability of the tank, but also it's a function of how well our support equipment works. We have found in developing these availability rates is that what is driving the tank availability down so low is the very things that have been discussed here—the test and diagnostic equipment, the manuals, and those types of things.

I'm not saying that those aren't important. They are, because it's necessary that they work well if you're going to support the tank in the field. But the test equipment exclusively can kill you in this operational formula, and that's exactly what's happening, because once we diagnosis what's wrong with the tank, it doesn't take too long to fix it.

Our problem—and I think General Ball would agree with me—is that we've simply got to develop some better test and diagnostic equipment to enable us to get a handle on what is wrong with the system.

Senator PROXMIRE. I appreciate very much that explanation, General, but it seems to me that availability is an absolutely critical factor.

General KIRWAN. It is.

Senator PROXMIRE. I'm a little puzzled here and in a dilemma as to which is the proper figure—the 80 percent given to me by General Ball or the 48 percent. There's an enormous differemce here. One indicates what seems to me to be a rather low level of availability.

General KIRWAN. Part of it can be explained by the fact that under the Army's operational reporting system, if General Lawrence can get his tank up within 12 hours using organizational maintenance or within 8 hours using support maintenance, the tank is counted as being operationally available.

Now I count every minute the tank is down. If he can get it up, under the Army's operational readiness reporting system, within 12 hours, his tank is not down. Now you can't fight with it during those 12 hours it's down, but for operational readiness reporting purposes, that tank is not down. So that explains partially why we've got different figures here.

General BALL. Sir, could I offer a couple of comments that I think are pertinent?

Senator PROXMIRE. I want to yield to Senator Jepsen, but first go ahead and finish. Then I'll yield to Senator Jepsen.

General BALL. In the RAM–D numbers, we mentioned schedule compression—producing it in 7 years. We knowingly moved ahead into the testing using seven tanks. For our record testing, we used 7 of the first 17 vehicles produced. Acknowledged, we had some rather substantial quality problems in these first tanks. This required some rather aggressive action. In fact, right after we started the tests last September. It also impacted on our test sets.

We originally planned seven test sets. The contractor developed seven tests peculiar to the tank. We tested these in the first series of testing; they didn't do the job for us. We went back on a crash program, and within a period of about 1 year, we developed a new series of test sets—the simplified test equipment (STE–M–1) for organizational diagnostics, the D sets for direct sets, and then the TSTS, the terminal system test set.

Acknowledged, again, that at the time we started the initial test and from the time General Lawrence got his first tanks at Fort Hood, we had a great deal of immaturity in our STE–M–1, the organizational level test set. We're getting about 90 to 95 percent accuracy in performance out of the other sets. We're getting anywhere from 50 to 75 percent now out of the STE–M–1. We were lower initially; we've made some modifications. We have made, I think, substantial progress. We still have improvements to make in our test sets, and manuals.

M–1 SUPPORT AND CREW MANUALS

This is the first major system to be fielded with the new type manual called "The Skill Performance Aid". We have two aspects of that—one, our ability to do the manual as well as it ought to be done and, two, we have a learning situation with the soldiers in the field because they're long accustomed to a differently formatted manual. We've both learned from that. We've gone through extensive reviews of the manuals and have fielded an April edition. In fact, at the organizational level, we have full validation and verification of the manuals that have gone into the field. But that has contributed to the time in repair; it contributes to the downtime that the system has experienced in our testing to date.

Senator PROXMIRE. General, my time is up.

General LAWRENCE. If I may, Senator, add just one thing to that. The Army has, I believe, made a wise decision in the fielding of these

manuals. We still have them in draft. Based on the experience of my battalion, we have made changes which have immediately been incorporated by the project manager, so that when we publish these manuals several years hence, we will have a very accurate and very supportive manual.

I might also indicate that the two platoon sergeants who I have here have become, over the past few months, very familiar with those manuals, and they might comment on the adequacy and utility of them.

Senator PROXMIRE. Senator Jepsen.

Senator JEPSEN. Thank you, Senator Proxmire.

I was going to discuss the manuals briefly. Everybody understands that the training and repair manuals for the tank have been somewhat inaccurate or are reported to have been inaccurate and difficult to read. Drawings often appear in these manuals depicting parts that are no longer in the tank. It goes on to say in the GAO report that the manuals frequently do not correctly specify the required tolerances needed, repair parts, test equipment, special tools, and so on.

I understood General Ball to say that all of these things are being corrected. Is that right? With the latest edition in April they are corrected?

General BALL. Sir, there are two tasks remaining for some of the manuals since our April iteration. We haven't gone through the full validation verification on our support manuals. We have completed this task on the crew manual.

Second, we are learning some lessons as we go along and finding better ways to structure the diagnostics logic—the instructions on how to troubleshoot the system—to match that up with the effective utilization of the test set. We're making some changes in formating there.

But my feedback and my assessment from the field is that each step has been progressive and that we have good manuals now. There's still room for some improvement.

I would defer to the sergeants, if I could, on the crew manuals because I think they are very familiar with those. They've seen it through about three iterations and now have in their hands the April 1981 edition.

Sergeant MAGGARD. Sir, the main thing I'd like to point out about the manual we've got now currently on the M-1 tank is the ability to learn how to use them. At the reading level and the explanation level in the technical manual, the style is such that you could probably take your average person off the street, and with just a little bit of training and instruction on how to operate the manual and some of the terminology that we associate with armor, he can become proficient on the manual. Like I said, the technical manual goes into great detail. It's not generalities that we deal with; it's very specific. The illustrations are good, and there are further references that direct you to other parts of the manual if you need assistance with those illustrations. So it's quite indepth, and I feel it's a more than adequate manual.

Senator JEPSEN. Were the manuals at one time showing charts, depicting parts no longer in the tank, erroneous tolerances, this type of thing? Were they in that state of disarray?

I'm not making a statement; I'm asking a question. The GAO says that's so. Is that so, or is it not so?

General BALL. Yes, sir. I acknowledge that the early manuals were not as mature as I think would be appropriate to have.

Senator JEPSEN. But is it correct?

General LAWRENCE. We submitted from Fort Hood alone over 300 changes to the technical manual. They have been very responsively acted upon by the contractor and the project manager, and the latest manual provided us, has been a continuing major improvement over the original manuals we received.

Our crew manuals, the manuals which Sergeant Maggard and Sergeant Braggs deal with on a daily basis, we think, are quite good. There are still some more changes, some improvements to be made in the technical manuals for organizational level, for the automotive mechanics, and the turret mechanics. But as we find those mistakes—and we can only find them through operational utility—we're making those suggested changes, which are being responsibly acted upon

OBSOLETE REPAIR PARTS

Senator JEPSEN. Is the GAO correct in stating that more than $400 million worth of spare and repair parts may be obsolete now because of design changes ordered after the parts were received? Is that an accurate statement?

General BALL. Sir, I think that's very improbable, certainly not $400 million worth. That figure is the total value of spare parts on order. Most of the parts delivered to date have been in the configuration that matches our currently fielded vehicles. Certainly there will be some changes across time. But we have a provision in the contract so that the repair parts supplier has contractually agreed to provide us with delivered repair parts that conform to the configuration of the tanks being produced at the time he delivers the parts. I think the obsolescence of repair parts will be minimal.

Senator JEPSEN. So the GAO report in that area where it states that more than $400 million worth of spare repair parts are obsolete because of design changes is not correct?

General BALL. Sir, if I rendered all of them that we have on order now are obsolete, that is what it would take to get to that figure.

General LAWRENCE. I think there's another issue, sir, I might point to. I mentioned it briefly in my statement, but I think it's a significant factor to be considered.

When we originally received the tanks, we received a package of repair parts totaling about 2,100 line items of repair parts at the direct support level. This was based on engineering estimates by the contractor and project manager as to our need for repair parts.

Our demand data for repair parts over the past 10 months has not reflected that amount at all. In fact, in our latest assessment of demand data to determine our authorized stockage list for repair parts, we have reduced that 2,100 figure to approximately 836 line items—a significant reduction—which tells me that our original estimates were far more pessimistic than we have actually experienced through experiential data over the past 10 months.

Senator JEPSEN. I'm not trying to pick the specks out of pepper. I'm supporting of the level of defense we need to keep the peace. I think I have a reputation for that as a member of the Armed Services Committee. I'm not hostile.

But for the record, I want to pursue some of these things because that's what you're going to read about and hear about, whether it's apples or oranges, whether it's valid or not valid. As long as somebody says so and it's sensational, that's what the American public is going to hear about.

You mentioned these 2,000 items. Well, the GAO mentions in their report that Chrysler was allowed to buy 2,000 varieties of nuts, bolts, transistors, and other new parts that differ only slightly from parts already in stock in the Defense Logistics Agency, thereby driving up the cost.

Is that an accurate statement, or is it not an accurate statement?

General BALL. Sir, I cannot substantiate except that, yes, Chrysler under the terms of the contract, as systems integrator, has a contract that permitted them to design and build a tank to comply with the specifications spelled out in the contract. They did have a requirement to use standard stockage parts any time they would meet the needs. Moreover, we have a screening process within our Material Readiness Command that if there is a part in stock in the Army stockage system or in the Defense Logistics Agency that will meet the requirement, we don't buy the different part; we use the standard part.

The statement is basically true that Chyrsler did have the latitude to select parts within an overall system of performance specifications within a design-to-unit hardware cost target and within the guidance to use standard parts if they would meet the requirement.

Senator JEPSEN. What's the Army's position with regard to the GAO allegation that hundreds of millions of dollars have been lost because the Army tried to keep costs down by inexpensive parts that wear out rapidly instead of costlier but more durable ones?

For example, the GAO said, "The tank has plastic instead of Teflon coated wiring used in British tanks for long life." Now that was in their report.

Would you comment on that?

General BALL. Yes, sir. That's addressing the convoluted wiring harness that's used in the Centurion tank, and I think it's influenced a great deal the individual who has promoted the use of that harness or the selected individuals by the experience we had on the Sheridan, the M–551, when we had a great deal of wiring harness problems. This has been assessed. In fact, quite recently, Chrysler went to vendors and compared the prices for three selected harnesses. It ranged from 50 percent to 250 percent more to use the convoluted wiring harness.

Most of our failures in wiring harnesses are in connectors, not in the harness itself. To date, in 73,000 miles of production testing, I've had eight wiring harness failures in which it might be shown through analysis that had we had convoluted cable; it might or might not have failed, because it has greater resistance to shear. It's a tougher cable, but it's a great deal more expensive.

Senator JEPSEN. I appreciate what you're saying, except I don't—I'd like to stop and try again.

Just please try to give a response to the allegation that hundreds of millions of dollars have been lost because the Army tried to keep costs down by buying inexpensive parts that wear out more rapidly instead of costlier but more durable ones.

Is that an accurate statement?

General BALL. I think not, sir. I can't substantiate the statement.

Senator JEPSEN. Why would they make it?

General BALL. Sir, any comments I would have would be in the realm of opinion and subjective.

Senator JEPSEN. Well, as of June—if I may, Senator, one final one.

MANUALS AND RAM–D

According to the things—just with the manuals and just with some of the other reports here, the GAO indicates that test results indicate that many problems have come to the surface. It's doubtful that the M–1 can achieve all of the reliability, availability, maintainability and durability requirements. It goes on to warn that if the Army goes ahead with its production commitments before the tank can be effectively operated and maintained—from what we've just in the last few minutes talked about, the manuals just aren't up to speed yet—is that correct? Are they getting there?

General BALL. They're not up to where we want them, sir. We are capable of maintaining the systems with the manuals as we have them today.

Senator JEPSEN. How far are we away, finally, in your opinion, from taking and going into the production of this tank and moving into the battlefield positions in Europe?

General BALL. Sir, I feel confident that if we had the tank in numbers and the capability, we would be able to go into battle with it in Europe today, far in preference to the other alternatives.

Senator JEPSEN. You mean, you would say that we're OK to go into production, full production now?

General BALL. In my judgment, yes, sir.

Senator JEPSEN. And that the reliability in combat, as per this headline this morning, is more than 30 miles?

General BALL. Yes, sir. I have absolute confidence it is. The probability with our current durability rates of making a 50-mile dash is about 0.98.

Senator JEPSEN. I have some final comments, but I'll withhold them.

Senator PROXMIRE. Last year, gentlemen, Congress required that the Army certify that they had met RAM–D requirements before requesting new funding. But you're requesting new funding, and you still haven't met those RAM–D requirements.

Let me just refine that question a little bit. Based on the GAO report and your own testimony, how do you explain the fact that the Deputy Secretary of Defense certified to Congress in March of 1980 that the M–1 had met the RAM–D requirements, and how do you justify recommending that the production rate and funding be increased from 30 to 60 tanks per month before these requirements are met?

General BALL. All right, sir. The 1979 test results were based on the full-scale engineering development tests in which, after the assessment, it was assessed that the combat mission reliability was 326 mean miles

between failure. The system reliability was 111, and the power train durability probability of 4,000 miles was 0.54.

We are addressing today numbers that are emerging numbers from tests that have not yet been subjected to the assessment conference to assess the validity of corrections that have been applied. The numbers will go up from where we are today. I fully expect to see combat mission reliability and system reliability to be above the thresholds established.

Senator PROXMIRE. You expect that. But the fact is you have not met the reliability, availability, maintainability, and durability requirements as yet; isn't that correct?

General BALL. Yes, sir.

What I am saying is that those will be reached at the end of tests, after some other things have happened that have not yet happened.

Senator PROXMIRE. But didn't the Congress require that the Army certify that you had met these requirements before you requested funding?

Colonel AGUANNO. Yes, sir, at that point in time. That was at the end of the full-scale engineering development phase. Each phase of the development has a unique set of reviewing requirements to which the demonstrated results compare to.

Senator PROXMIRE. How did you testify to the requests since you hadn't met what Congress asked you to meet?

Colonel AGUANNO. At the time that request was made, at the end of full-scale engineering development, FSED, with those tanks, we had met the durability requirements for the FSED phase. And therefore, the certification made was indeed correct.

Now we have production vehicles that we're testing at Fort Hood and places like that. And we have incorporated production problems. Of course, when you go into production there are some other failures that have been discovered, and for the most part, corrected.

Senator PROXMIRE. But you say that at the time you requested the funding, you had met the reliability and maintainability and durability and availability tests; is that correct?

Colonel AGUANNO. When the certification was made, that's correct, sir. It should be noted, however, the RAM requirements for the production phase are higher than those for the last phase and hence more difficult to achieve.

Senator PROXMIRE. Although you concede that now you don't need them?

Colonel AGUANNO. With a different set of production vehicles, that's correct, sir.

COST EFFECTS OF TANK DEFECTS

Senator PROXMIRE. Let me ask you this. What protection does the taxpayer have in the event the M–1 tank turns out to be defective? Will the taxpayer have to pay to recall them, as was done with the M–60A2; or to fix them, as was done in the case of the C–5A? Or is the taxpayer protected by some sort of warranty in the contract?

General BALL. Yes, sir. We have something a little different in this one. I mentioned it earlier. We call it the correction of deficiencies clause, in which we gave the contractor, the development contractor,

special latitudes in the design and the development of this tank. He was charged—he signed on to develop a tank that would meet these operational characteristics—and that if the tank failed to do so in the tests that were carefully laid out, the contractor was liable to make the corrections necessary to cause the system to meet these characteristics within the ceiling costs established in the contract.

So, when we're addressing these, the contractor is contractually responsible to meet these requirement specifications.

Senator PROXMIRE. So you're telling us, if the tank is defective, it would be fixed at cost to the contractor and not the taxpayers; is that correct?

General BALL. Yes, sir. He has to demonstrate that he has fixed the deficiencies. Then he has to go back and retrofit the first year's production tanks to incorporate that fix.

Senator PROXMIRE. And there'll be no increase in cost?

General BALL. If it's within the ceiling price of the contract; yes, sir. The indications are, and my cost estimates say, he is approximately at ceiling cost.

Senator PROXMIRE. If it's at the ceiling now, then he would have to fix it at his own expense?

General BALL. Yes, sir. If he's not at ceiling, it comes out of his profit.

Senator PROXMIRE. But he is at the ceiling now, as a matter of fact?

General BALL. Effectively, yes, sir.

Senator PROXMIRE. In the case of the M–60A2, who was the contractor? And who will pay the costs of those defective tanks, the taxpayer or the contractor of the M–60A2, the ones that were recalled?

General BALL. Sir, Chrysler was the contractor, but I can't address the terms of that contractor.

Senator PROXMIRE. Chrysler was the contractor.

Colonel AGUANNO. Chrysler was the manufacturer; yes, sir. And you want to know what guarantees or warranties?

Senator PROXMIRE. I want to know who will pay the cost, Chrysler or the Federal Government?

Colonel AGUANNO. Well, the cost——

Senator PROXMIRE. The cost of the defective tanks. Those tanks came back. We lost what—$300 million on them?

Colonel AGUANNO. No, Sir.

Senator PROXMIRE. Well, you say you think you can use them for something now.

Colonel AGUANNO. Sir, there were some reliability factors that do not match up to the current state of technology. And therefore that weapons system is not the biggest bang for the buck for a weapons system that should remain fielded. That's correct. The threat has changed.

Senator PROXMIRE. That's a masterpiece of understatement.

Colonel AGUANNO. Thank you, sir. [Laughter.]

There is no way to define the costs which you want to attribute to the manufacturer at this time. The contract provided a certain amount of tanks to perform and to be accepted. As it came out the door, they met those specifications, and the tank was fielded.

Senator PROXMIRE. So you're saying, in this case, the Federal Government is the fall guy, the taxpayer is the fall guy?

Colonel AGUANNO. I will say there is no retribution.

Senator PROXMIRE. Whatever loss is involved in these tanks—and it appears that there is some—although you say—and if we can use it for some other purpose—nevertheless, those tanks that were sent to you and are now recalled—what is it 500 of them?

Colonel AGUANNO. We bought a total of 540; yes, sir. We did not send them all to Europe. Any financial retribution due from the contractor would be zero at this time, sir.

Senator PROXMIRE. So that the taxpayer will have to pay the cost?

General LAWRENCE. I think it's important to note, also, that these tanks have been operational in Europe for a period of time. They have done the job.

Senator PROXMIRE. How long?

General LAWRENCE. I don't have that exact information; 1974 or 1975. So they have been in Europe a period of time to perform an operational mission which was necessary.

When we put the M–1 tank into the field and draw out the M–60's, they will have been doing their job for 20 years. And when we retire them from the inventory or refurbish them and move them into other units in the operational fleet, that's the price that we pay.

Senator PROXMIRE. Yes; but the M–60A2 was in the field for what—6 or 7 years, approximately?

General LAWRENCE. Yes, sir.

Senator PROXMIRE. And it was withdrawn, it was not contemplated at the time that it would be 6 or 7 years' service; was it? Didn't we expect that to last for 20 years or more?

General LAWRENCE. Sir, we considered that this was an interim tank, to fill the bill for a long-range tank killer, with a missile system.

Senator PROXMIRE. I earlier asked how long, and I certainly got the distinct impression that you did not expect it to be only the short time that it was used.

General LAWRENCE. Sir, we certainly didn't expect it to be our mainline battle tank. We only built 540 of them. Most of them went to Europe, to perform a specific role.

Senator PROXMIRE. There's no record that you told the Congress at the time that the tank would probably be recalled after 6 years?

General LAWRENCE. Sir, I can't speak for that. I wasn't involved at the time, But certainly none of us who are tank officers ever believed that the M–60A2 would be the main battle tank of the U.S. Army. We only built 540 of them; we put them in Europe as a long-range tank defense, to hold the line until we could build a system like the M–1 which could redress the imbalance.

Senator PROXMIRE. I don't like to go over the same ground again, but the GAO said—and you conceded today that this is true—the M–60A2 tank was deployed to Europe in 1974, with serious hardware design problems and inadequate logistics support capability—that is, trained personnel, test equipment, spare parts, and technical manuals. Support costs have been high, and the system has never outgrown its reputation as an unsupportable tank. That's what the GAO said, and you I thought conceded that.

General LAWRENCE. Sir, I don't mean to confuse you on that. I didn't speak directly to the supportability of the tank, I spoke to the operational need for the tank.

The fact that the manuals may have been inadequate, the test equipment may have been inadequate, and that the reliability was not sufficient is an issue apart from the operational need.

Senator PROXMIRE. Why should the taxpayer have to pay for equipment that had hardware design problems?

General LAWRENCE. Sir, I don't want to pay for that either.

Senator PROXMIRE. Why didn't the Army design a contract that would impose whatever hardware design problems that would develop on the contractor?

General LAWRENCE. Sir, I endorse what you're saying for the M–60A2. But the issue today is the M–1 tank and whether that tank is needed on the battlefield, whether its utility will replace and improve the utility of the M–60 on the battlefield.

Senator PROXMIRE. Let me ask you about the M–1 then. In your judgment, do the M–1 tank contracts adequately protect the taxpayer by spelling out scheduling performance requirements for the tank and its components, so that if there are delays and failures, the Army will have recourse against the contractor?

General LAWRENCE. General Ball would have to answer that, sir. But as a taxpayer, as well as a soldier, I would say, on the basis of what I know, yes.

Senator PROXMIRE. General Ball.

General BALL. Substantially better than other major systems in terms of meeting performance specifications. There is no specific cost penalty to the contractor for schedule delay.

Senator PROXMIRE. There have already been production delays of the engine and the tank. Who has paid for those?

General BALL. Sir, that comes within the ceiling price of the contract.

Senator PROXMIRE. The contractor has paid for those, you say; is that right?

General BALL. If we would otherwise have gotten the material at a lower cost, we would have had a sharing arrangement with the contractor. But his commitment is to produce it at ceiling. Production delays eat into his profit. We share 89 percent of the contractor.

Senator PROXMIRE. Your statement is that this is below the ceiling, and therefore the costs have been shared by the taxpayer and the government?

General BALL. Eighty-nine percent contractor, eleven percent Government.

Senator PROXMIRE. What's the share?

General BALL. 89–11, sir, between target and ceiling. The contractor takes 89 percent, the Government share is 11 percent. At ceiling, it's all the contractor's.

Senator PROXMIRE. Senator Jepsen.

ESTIMATED COSTS OF M–1 TANK PROGRAM

Senator JEPSEN. If this program, as proposed, is completed, what is your estimated cost to complete, purchase, and put in the field the number of tanks? Is it 7,058? Is that the number?

General BALL. 7,058 is the correct number. The current total procurement cost estimate is $17,598,700,000. To that, we add almost $1 billion in R.D.T. & E. cost, for the total program cost of $18½ billion.

Senator JEPSEN. So that the program costs listed here, of about $19 billion, is a ball park figure?

General BALL. Yes, sir. It changes every time the inflation indexes change.

Senator JEPSEN. That would buy 7,058 tanks.

General BALL. Yes, sir, plus research and development for the entire package.

Senator JEPSEN. A side comment. We've given an awful lot of information to folks all over the world about our problems with our tanks and some of our military equipment. It saves their intelligence a lot of trouble.

I'd like to advise those same folks that if I and some of my colleagues had our way about it, we'd have neutron warheads and we'd train our tank crews to operate Russian tanks. If they move, we'd neutralize them, and then put our crews in, turn them around, and send them right back to them. That would be a little better than talking about 7,000 tanks, which we really ought not to be here talking about at this time had we done the things that needed to be done years ago.

Thank you, Senator Proxmire.

Senator PROXMIRE. Thank you, Senator Jepsen.

I might say that I think that the hearings like this are very, very helpful. They're certainly helpful to me, and I hope they're helpful to the Army. If they aren't, you ought to tell us that they are not. And certainly you should not offer any information, under any circumstances, you felt might compromise our position; and I'm sure you would not.

Any question that I ask or any other member of the committee asks at any time that, in your judgment, might constitute a breach of security or give any benefit or comfort to any potential enemy, I'd hope you'd call it to my attention directly. And I certainly wouldn't request an answer. That's your job, and it's our job, too, to be very careful about that.

I think Senator Jepsen makes a point—we all ought to be cautious and careful. But I do think one of the great strengths that we have in this democracy is that we criticize and debate and discuss. That's the only way it can improve.

I appreciate your appearances and testimony here today. I hope it's understood by all that we owe it to the taxpayer to scrutinize government expenditures and military programs. We've been burned in the past by assurances of the expensive weapons that were ready to go into full production and be deployed abroad.

In my view, there is evidence that what we have in the M–1 is a breakdown-prone, hard-to-maintain, costly, land-borne version of the C–5A. It wouldn't make good business sense to mass produce a piece of equipment that failed its tests, and doesn't make good military sense to continue business as usual with the M–1. The M–1 is simply failing its tests in several critical areas.

But I thank you gentlemen for your appearance. You've been most responsive, and we appreciate that.

The subcommittee will stand adjourned.

[Whereupon, at 12:40 p.m., the subcommittee adjourned, subject to the call of the Chair.]

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